THE JOURNAL
OF THE
Society of Chemical Industry:
A MONTHLY RECORD
FOR ALL INTERESTED IN CHEMICAL MANUFACTURES.

No. 4.—Vol. IV. APRIL 29, 1885. Non-Members 30/- per annum; Members 21/- per Set; Single Copies 2/6.

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NOTICES.

In accordance with the provisions of Rule 18 of the Bye-laws, notice is hereby given that those members of Council whose names are placed in italics in the annexed list, will retire from their respective offices at the forthcoming Annual General Meeting.

Mr. Edmund K. Muspratt has been nominated to the office of President, and Dr. W. H. Perkin, F.R.S., has been nominated Vice-President under Rule 11.

Mr. I. Lowthian Bell, F.R.S., Dr. Peter Griess, F.R.S., Mr. John Spiller, and Mr. E. C. C. Stanford have been nominated Vice-Presidents under the provisions of Rule 8; and Sir Bernhard Samuelson, Bart., M.P., and Dr. S. A. Sadler have been nominated ordinary members of Council in the place of Dr. Peter Griess, F.R.S., and Mr. John Spiller, nominated Vice-Presidents under the provisions of Rule 17.

The Treasurer and Foreign Secretary have been nominated for re-election.

Members are hereby invited to nominate fit and proper persons to fill the four vacancies thus created among the ordinary members of Council, in accordance with the provisions of Rule 18. Nomination forms for this purpose can be obtained from the General Secretary upon application.

Members are hereby informed that the Annual General Meeting (1885) will take place in London in the second week in July. Details and arrangements will be published in due course, and members will receive their tickets of membership, which, as heretofore, will form vouchers in visiting works and places of interest.

Authors of papers printed in the Journal are hereby notified of the fact that, in accordance with Bye-law 43, they are entitled to receive not more than 50 gratuitous copies of their papers. Authors should state on their manuscripts their desire to have free copies, adding the number wished for. Unless the contrary be specially desired, this being stated on the manuscript, the reprints of an author's paper will not include the report of any discussion that may have arisen after the reading of the paper.

Members are hereby advised that the Subscription for 1885 falls due at the beginning of the year, and should be paid as soon afterwards as possible. The Council has decided that after January 1st, 1885, the 29th Bye-law will be strictly enforced, so that Members whose subscriptions are more than four months in arrear, will not continue to receive the Society's Journal.

Inquiries having been made as to the transactions of the Newcastle Chemical Society, the Committee of the Newcastle Section have to state that a very few complete sets are remaining, and will be sold to members at £2 10s. per set. A number of separate volumes can also be had by members wishing to complete their sets, at 10s. per volume (generally three years' issue). Application for these should be made to the Local Secretary of the Newcastle Section.

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MEETINGS, SESSION 1885—First Monday in each month (unless otherwise indicated).

May 4.—Messrs. Giles and Shearer—"The Real Strength of Aqueous Solutions of Sulphurous Acid."

Messrs. C. Napier, Hake, and Mook—"The Stassfurt Salts Industry, and its bearing on other Industries."

Discussion on Professor Munro's paper published in January number of the Journal, "On the Manurial Value of Filter-Pressed Sewage Sludge," read January 5.

June 1.—Messrs. Salamon and W. de Vere Mathew—"The Influence of Phosphates upon Fermenting Worts." Mr. H. B. Yardley—"Additional Note on Alumina in Superphosphate."

July.—The Annual General Meeting.

Notices of papers and communications for the meetings to be sent to the Local Secretary.

Meeting held April 13, 1885.

FURTHER NOTES ON THE RADIAL PHOTOMETER AND THE PROPOSED STANDARDS OF LIGHT.

BY W. J. DIBDIN, F.I.C., F.C.S.

Chemist, and Superintending Gas Examiner to the Metropolitan Board of Works.

ONE of the first points which it is desirable to make clear, with regard to the use of the Radial Photometer is the certainty attending the use of the instrument when the disc is arranged for equal angles of incidence of the rays *from the standard and the light* under examination. For the purpose of determining this question, I have made tests of the horizontal rays, with the disc in various positions—viz., vertical and inclined 22° and 45° in either direction, with the result that the readings obtained were perfectly concordant. It may, therefore, be assumed that the tests of rays, at angles above and below the horizontal, are correct when the screen is adjusted as I have directed. It is necessary that care should be taken to avoid errors due to reflection.

In the paper which I had the honour to submit to the Society last year, I drew attention to the difference in the quantity of light emitted from the broad part of flat flames, and from their edges. This question has since engaged my attention. I have made determinations of the quantity of light afforded in all directions horizontally by three classes of flames, testing them at every 10°. The results are stated in Table I. The diagrams show at a glance the positions in which the maximum light is thrown.

The value of the radial photometer is most strikingly shown in the examination of burners shaded by globes, reflectors, etc. For this purpose I have tested three Argand burners, fitted with different forms of shades. Table III. contains the results, which I have also put in diagram form. Two of these sets of observations clearly indicate that the form of the porcelain cup might be arranged to yield more satisfactory results, but considering the want of a suitable method of testing, before the radial photometer was introduced, there is little room for complaint. The effect of the well-known glazed-paper shade is very striking, the even distribution of light downward being very satisfactory. The tests of a Christiania burner, with and without its globe, are also interesting; but, as in this case the globe has to do the double duty of regulating the draught and reflecting the rays in a downward direction, it is difficult to see how its form can be improved. The tests of a new form of reflector well illustrate the character of the work of which the radial is capable. The tests may be taken at every degree where necessary, and thus most valuable comparative results obtained.

These instances might be multiplied almost indefinitely, but I do not think that more are required to point out the extensive range of work which this photometer renders possible. Further practice has shown that tests are easily and rapidly made, and that it is equally applicable for all classes of photometrical experiments.

The effect of a suitable reflector in diffusing the power of the light in particular directions is very marked, so much so, that in future competitive tests of burners and apparatus relating thereto, it would be highly desirable to make special awards for the best form and diffusing power of reflectors. In my judgment the most perfect reflector should throw the rays of light in such a manner as to evenly illuminate a level surface comprised within a circle whose circumference includes those rays *falling at an angle of* 30° below the horizontal.

The nearest approximation to this definition is the result given by the well-known porcelain shade supplied with Argand burners. When the cup is in position the rays, falling at all angles from 0° to 60° below the horizontal, are intercepted to an excessive extent. The importance of facility in testing a new disc for photometric readings is generally acknowledged. The form of carrier used with the radial photometer is especially adapted for readily adjusting the disc, so that either side may be turned towards the standard light. It is only necessary to loosen the screw holding the carrier when the latter can be rotated *on its axis*. I propose to use this form of disc carrier, which reverses the mirrors as well as the disc, in the photometers at the gas-testing stations of the Metropolis under my charge, and have obtained the sanction of the Gas Referees to the change, which, I feel certain, will be a decided advantage.

The Proposed Standards of Light.

Amongst the numerous proposals for obtaining a light of constant illuminating power, the most varied substances are to be found; in fact, hardly a combustible material seems to be omitted from the list. It is unnecessary to recapitulate them further than to call attention to those which have been found, after repeated and lengthy trials, to afford ground for the hope that amongst them may be one which will eventually prove to be reliable under all circumstances. These are six in number—viz., candles; Carcel and Keates' lamps; Harcourt's pentane or air-gas flame; Methven's screened Argand flame; and Sugg's "Ten-candle Test." The combustibles employed with these are sperm, sperm and colza oils, pentane, and coal-gas both with and without pentane.

I need hardly mention that the only legal standard in this country is the sperm candle of six to the pound, each consuming 120 grains of sperm per hour, and that the Carcel is the legal standard in France. This lamp should consume 42grm. of colza oil per hour, at which rate it yields an average light equal to 9·5 average English candles. I have obtained this figure from the results of tests made in 1870, by Mr. Sugg, when he found it to be equal to 9·6 candles, and the mean of several series of tests which I have recently made, when I compared it with both Mr. Harcourt's pentane flame, and the Keates lamp, the average result being that the Carcel lamp was equal to 9·41 candles. If it is assumed, therefore, to be equal to 9·5 candles, it is certain that that assumption will not be far from the truth.

The attention which has been paid to the important subject of the standard of light during the past few years has resulted in three separate investigations being made. The first of these was in 1880 and 1881, when the Board of Trade appointed a committee, consisting of Drs. Williamson and Odling, and Mr. G. Livesey, to examine "the Standards at present in use for estimating the Illuminating Power of Coal-Gas, and of the Standards which have been proposed by Mr. A. G. Vernon Harcourt, Mr. T. W. Keates, and Mr. J. Methven." The report of this committee was very unfavourable to candles, Keates' lamp, and Methven's screen, but decidedly in favour of Mr. Harcourt's air-gas flame.

In 1883, the Gas Institute appointed a committee to examine the candles, Mr. Harcourt's air-gas flame, Mr. Methven's screen, and M. Giroud's "Verificateur," and "Relative" standard. This committee engaged the services of Messrs. Heisch and Hartley to conduct the experiments, and these gentlemen reported strongly in favour of the Methven screen, and as strongly against the Harcourt air-gas. During the past winter I have had an opportunity of making further examinations of the various proposed standards, and have submitted the results obtained, up to the present, to a committee of the Metropolitan Board of Works in the form of a report. I have not yet furnished my investigations, and hope to extend the number of tests and manner of making them very considerably. So far as my work has gone, I am of opinion that the public has now before it several propositions of a most promising character. I have found

TABLE I.

Flat Flame Burners. Illuminating Power of Horizontal Rays.

POSITION OF FLAME.		BURNER No. 1 CANDLES.	BURNER No. 2 CANDLES.	BURNER No. 3 CANDLES.
Flat to Photometer Bar		30·8	24·2	8·5
	Flame Turned .... 10°	30·8	24·2	8·5
	,, ,, ... 20	30·9	24·3	8·5
	,, ,, ... 30	30·9	24·2	8·5
	,, ,, ... 40	30·8	24·0	8·4
	,, ,, ... 50	30·2	24·0	8·3
	,, ,, ... 60	30·1	23·8	8·2
	,, ,, ... 70	30·2	23·5	8·2
	,, ,, ... 80	29·8	22·4	8·2
Edge to Bar	,, ,, ... 90	24·4	20·3	7·9
	,, ,, ... 100	28·7	21·6	8·2
	,, ,, ... 110	29·6	22·8	8·3
	,, ,, ... 120	30·3	23·5	8·3
	,, ,, ... 130	30·5	23·4	8·3
	,, ,, ... 140	30·5	23·2	8·3
	,, ,, ... 150	30·5	23·4	8·4
	,, ,, ... 160	30·1	23·5	8·4
	,, ,, ... 170	30·4	23·2	8·3
Flat to Bar	,, ,, ... 180	30·3	23·1	8·4
	,, ,, ... 190	30·4	22·8	8·4
	,, ,, ... 200	30·8	23·0	8·4
	,, ,, ... 210	30·8	22·7	8·4
	,, ,, ... 220	30·7	22·9	8·3
	,, ,, ... 230	31·0	22·9	8·3
	,, ,, ... 240	30·6	22·8	8·3
	,, ,, ... 250	30·1	22·0	8·2
	,, ,, ... 260	29·5	21·2	8·1
Edge to Bar	,, ,, ... 270	25·0	18·6	7·8
	,, ,, ... 280	28·5	20·6	7·8
	,, ,, ... 290	29·5	21·9	8·1
	,, ,, ... 300	29·7	22·2	8·3
	,, ,, ... 310	29·8	23·0	8·3
	,, ,, ... 320	30·3	23·0	8·4
	,, ,, ... 330	30·3	23·5	8·3
	,, ,, ... 340	30·5	23·4	8·4
	,, ,, ... 350	30·7	23·5	8·4
Flat to Bar	,, ,, ... 360	30·9	23·4	8·5

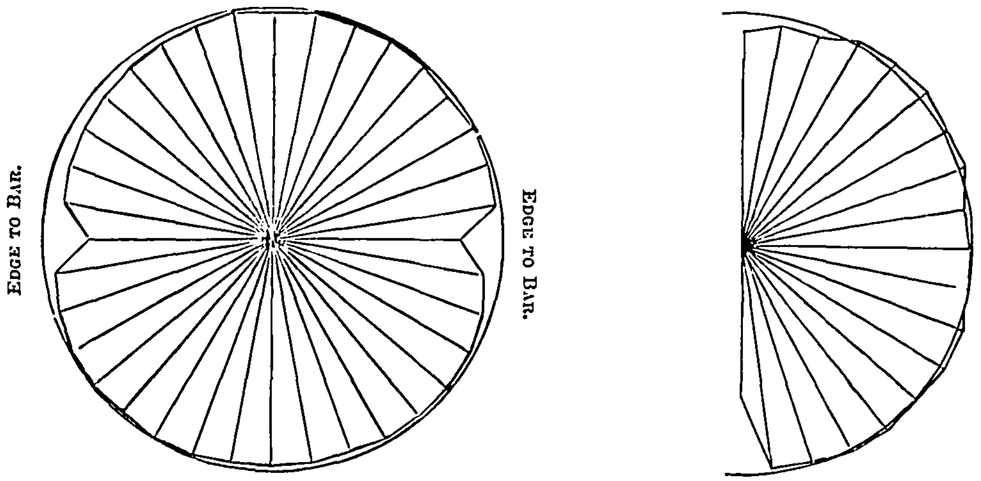
TABLE II.

Flat Flame Burners. Illuminating Power of "Angular" Rays.

DIRECTION OF RAYS.	BURNER No. 1 CANDLES.	BURNER No. 2 CANDLES.
90° above horizontal	27·8	8·9
80 ,, ,,	29·2	9·0
70 ,, ,,	29·0	9·3
60 ,, ,,	30·5	9·3
50 ,, ,,	30·8	9·2
40 ,, ,,	30·9	8·7
30 ,, ,,	30·3	9·4
20 ,, ,,	30·4	9·3
10 ,, ,,	29·4	9·3
Horizontal	29·8	9·7
10° below horizontal	29·9	9·9
20 ,, ,,	30·2	10·0
30 ,, ,,	30·2	10·1
40 ,, ,,	29·8	10·0
50 ,, ,,	29·8	10·0
60 ,, ,,	30·0	10·7
70 ,, ,,	29·2	10·3
80 ,, ,,	28·7	11·2
90 ,, ,,	19·6	5·8

that Mr. Harcourt's air-gas standard is very satisfactory in its results, and is easy to work. In this matter I regret to find that I am in direct opposition to the strongly-expressed opinions of the two eminent photometrists who reported to the Gas Institute committee so unfavourably of the pentane. I also found that the Keates lamp is thoroughly reliable, and of a most satisfactory character in every respect. The Methven screen gave very contradictory results, but I am willing to believe that these were in some degree probably due to two things: 1st, the too hurried use of the burner after lighting; and, 2nd, variations in the height of the flame. I found this latter to be a most important point when the carburetted gas was used, in place of the plain coal-gas. I confess to being disappointed with the Methven arrangement. I expected variations of a kind, but I was not prepared for some of the extraordinary results which were obtained. I am anxious not to do Mr. Methven an injustice, and am content, especially after the strongly expressed opinions of Messrs. Heisch and Hartley, to await the results of further tests, and in the meantime distrust myself, before finally rejecting a proposal which has met with such strong support. I have made some careful tests of a new form of standard introduced by Messrs. Sugg & Co., and called by them the "Ten-candle Test." As submitted it was arranged to burn common coal-gas of various qualities. The inventors do not claim that the light emitted is of constant quality when gases of various illuminating power are used; but, on the contrary, furnish a table of corrections for the particular gas employed. The limited number of tests which I have made with the arrangement has not impressed me favourably with the idea of using ordinary coal-gas as a standard combustible in this case more than with the Methven. I therefore tried the expedient of burning coal-gas enriched with the vapour of pentane. To my surprise I found that the quantity of light emitted by the system, when this rich gas was used, remained precisely the same as when the uncarburetted gas was employed—viz., 10 candles. This result was due to the fact that when the rich gas was employed, a greater portion of "blue" flame is obtained, which compensates for the increased quantity of light emitted by the portion of the flame utilised. This fact affords an explanation of the decrease in the quantity of light emitted through the Methven slot when the flame produced by carburetted gas is too high. The lower portion of the flame is brought nearer to the slot, which is thus opposed to a light of diminished intensity. So far as my tests have extended, I find that the "Ten-candle Test," when burning enriched gas, is remarkably constant, and well merits further trial.

FLAT FLAME BURNER No. 1.



HORIZONTAL RAYS.
Flat to Bar.

ANGULAR RAYS.

Summing up the general results of the tests which I have lately made, and expressing them, for convenience, in percentage variation from the mean, I find that the variations in the proposed standards were as follows—viz.:

PERCENTAGE OF TESTS WITHIN ONE PER CENT. OF THE MEAN.

Candles. Tests by different operators	13·7
Carcel Lamp. Tests with two lamps........	39·0
Keates' Lamp. Tests made with various lamps, oils, and wicks	71·0
Tests with one lamp, for constancy, Series No. 1	68·4
Tests with one lamp, for constancy, Series No. 2	87·5
Tests by different operators	58·0
Harcourt's Pentane. Tests of various samples of air-gas	91·0
Tests made by repeated adjustment of height of flame	100·0
Tests by different operators.................	41·0
Methven's Screen. Tests made with "plain" and "carburetted" gas	37·0
Tests by different operators	12·5
Suggs' "Ten-candle Test." Tests with "plain" and "carburetted" 16·7 candle-gas, and 11·2 candle-gas carburetted (eight tests only)........................	100·0

The objections to the above standards may be summarised thus:—

Candles.—Variability of composition and melting point of sperm, and of the number and size of threads.

Carcel Lamp.—Quality of oil employed. Uncertainty of height of wick and glass, and of composition of wick.

Keates' Lamp.—Time required to produce flame, and uncertainty attending the use of a wick.

Pentane.—Attention and skill required; sluggish and unstable character of flame; effect of vibration of room; difficulty of reading.

Methven's Screen.—Quality of gas used with "plain gas" screen. Uncertainty of height of flame, especially when carburetted gas is employed.

Suggs' Ten-candle Test.—Quality of "plain" gas used.

The replies to these objections are :—

Candles.—None.

Carcel Lamp.—Admitted.

Keates' Lamp.—The time is about thirty minutes, or little more than that required with any other of the proposed standards. With this lamp there is no uncertainty as regards the wick.

Harcourt's Pentane.—When the apparatus is properly arranged the attention required is so little as to be of no moment. The flame is perfectly steady in the absence of draught, or excessive movement of disc carrier. Accidental vibration of room does not affect it, and that the difficulty of reading the photometer disc is overcome by practice.

Methven's Screen.—When "plain gas" having an illuminating power between 14 and 22 candles is used, the light passing through the slot is constant, and can be checked by the use of enriched gas, and a smaller slot. The height of the flame is easily controlled.

Suggs' Ten-candle Test.—Variations in the quality of the gas employed do not affect the result, as correction is made for any increase or decrease in its illuminating power.

We have thus the present position of the standard of light controversy clearly defined. The conflict of testimony is so diametrically opposed that an outsider would naturally consider that either there is little disposition on the part of various advocates to admit the possibility of an opponent having good grounds for his assertions, or that the difficulties of the case are so great as to preclude one person using more than one system to the best advantage. The fact is that photometry is by no means a "two-foot rule" science. Nothing can exercise the patience of an operator more than prolonged observations of this character. Unremitting care and minute attention to numerous details are absolutely necessary for the attainment of accurate results. It is therefore not difficult to imagine that an operator intimately acquainted with all the peculiarities of a given standard should be liable to obtain more constant results with that than with another with which he may be less accustomed. The constant transition from one standard to another, each differing in every particular, and of varying luminosity, is most trying. Those considerations show that great caution is necessary in arriving at a judgment on the whole question, which should be approached with due regard to the opinions and experiences of others.

I have spoken previously in favour of a high-power standard, and I see no reason to alter that view, although I gladly admit the facility with which readings were made when the pentane air-gas was employed during my recent experiments. With practice and great care the results are satisfactory, but they cannot, in my judgment, be obtained with the same facility and comfort to the observer as

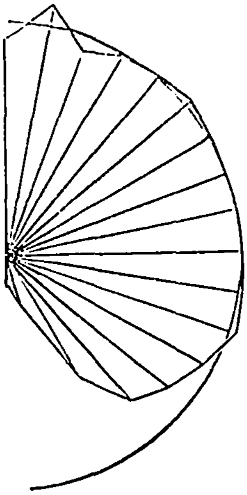
TABLE III.

Effect of Reflectors and Shades.

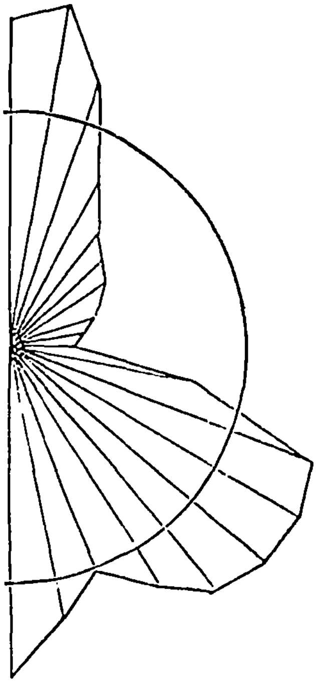
Direction of Rays.	Argand No. 1.			Argand No. 2.			Argand No. 3.		Christiania.		Union.	
	Without Shade, etc.	With Reflector only.	With Reflector and Cup.	Without Shade, etc.	With Reflector only.	With Reflector and Cup.	Without Shade, etc.	With Paper Reflector.	Without Globe.	With Globe.	Without Reflector.	With Compound Reflector.
90° above horizontal	16·8	27·6	33·0	19·0	25·0	29·0	10·6	9·3	...	17·6	...	...
80 ,, ,, ...	20·0	30·8	36·6	21·0	29·0	33·0	14·0	13·7	14·0	18·4	...	...
70 ,, ,, ...	17·4	24·4	31·2	19·4	21·4	28·4	14·2	12·9	14·1	19·3	8·7	9·2
60 ,, ,, ...	18·2	14·8	21·0	18·8	13·8	19·2	15·0	11·0	13·4	10·3	8·7	9·2
50 ,, ,, ...	18·6	11·2	14·8	18·8	10·0	14·0	15·6	4·0	13·6	8·4	8·7	9·8
40 ,, ,, ...	18·8	9·8	12·8	18·4	8·4	11·0	15·1	1·3	12·8	8·0	8·6	10·4
30 ,, ,, ...	18·6	9·0	11·8	17·0	7·8	9·2	15·1	1·3	13·0	7·0	8·7	12·6
20 ,, ,, ...	18.6	7·6	10·1	17·2	6·4	8·4	15·0	2·0	12·4	6·5	8·8	19·6
10 ,, ,, ...	18·6	6·2	8·8	16·8	5·4	7·2	15·0	1·0	12·3	6·7	7·2	50·0
Horizontal	18·6	5·2	8·6	16·8	4·8	7·6	15·0	...	12·2	7·0	6·6	28·0
10° below horizontal	18·8	14·4	13·8	17·2	16·0	15·0	15·6	2·0	12·3	7·6	...	12·2
20 ,, ,, ...	19·2	21·2	15·6	17·8	21·6	14·2	15·8	12·5	13·0	7·6	...	...
30 ,, ,, ...	18·2	25·6	12·2	17·2	23·0	12·0	15·6	25·4	12·7	8·0	...	...
40 ,, ,, ...	16·4	26·0	11·8	16·8	23·4	13·4	14·0	31·0	12·8	9·0	...	...
50 ,, ,, ...	15·2	24·8	13·2	14·4	23·4	16·2	12·3	30·8	12·3	15·0	...	...
60 ,, ,, ...	11·2	22·0	17·4	11·0	20·0	19·4	8·4	30·0	11·6	17·2	...	...
70 ,, ,, ...	6·0	18·8	20·8	6 2	17·0	23·4	4·8	29·4	10·8	15·1	...	...
80 ,, ,, ...	2·6	21·2	21·8	4·0	20·8	25·2	2·5	33·0	6·3	10·3	...	...
90 ,, ,, ...	2·0	25 6	26·6	2·0	20·2	23·6	1·0	30·4	1·6	7·0	...	...

ARGAND BURNER No. 1.

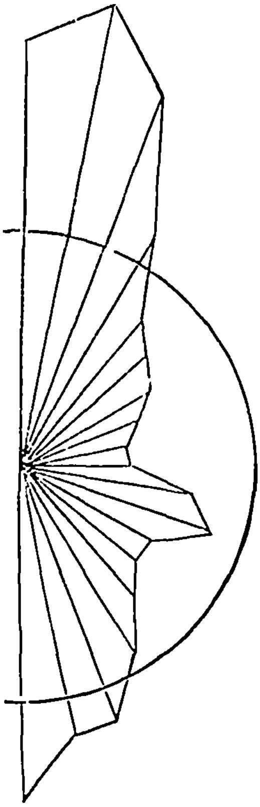
WITHOUT REFLECTOR OR CUP.



WITH REFLECTOR ONLY.

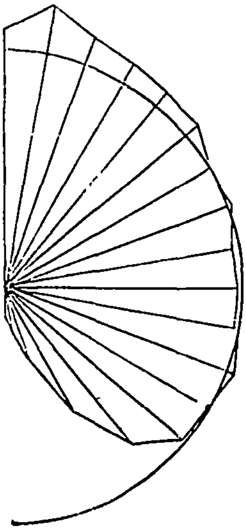


WITH REFLECTOR AND CUP.

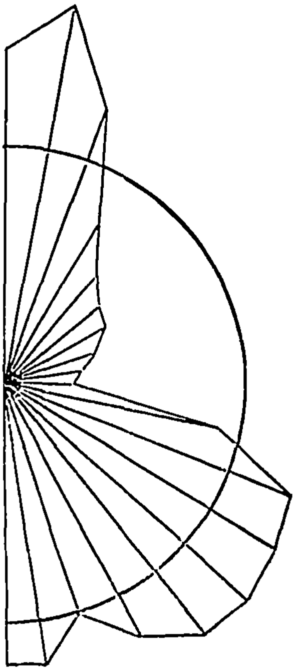


ARGAND BURNER No. 2.

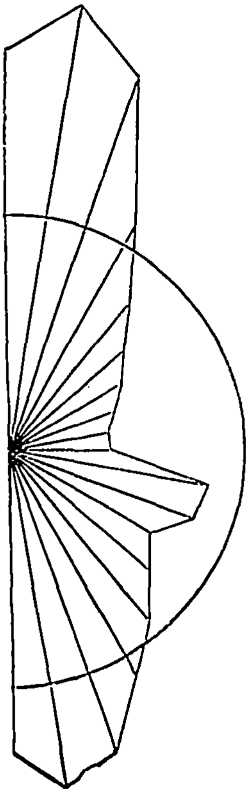
WITHOUT CUP OR REFLECTOR.



WITH REFLECTOR ONLY.



WITH CUP AND REFLECTOR.

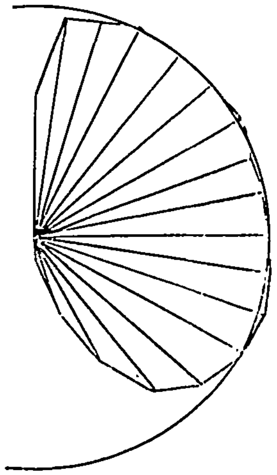


when a higher power standard, such as the "Ten-candle Test," or Keates' lamp, is used.

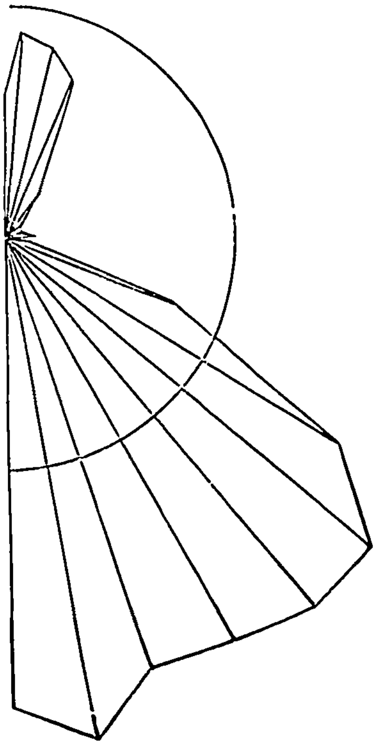
It is highly desirable that the standard combustible employed should be of a definite character. For this reason I do not think that plain coal-gas is admissible. Its constant variation must be a source of frequent liability to error; moreover, a standard of light should be self-contained, and available under all conditions. Circumstances will arise in which coal-gas may not be attainable. Many authorities seem to overlook this fact, and speak of a standard of light as if it was solely desired for the purpose of gas testing. I prefer

ARGAND BURNER No. 3, WITH AND WITHOUT CARDBOARD SHADE.

Without Shade.

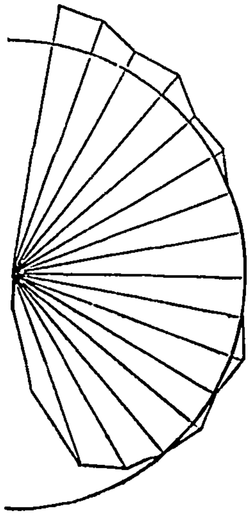


With Shade.

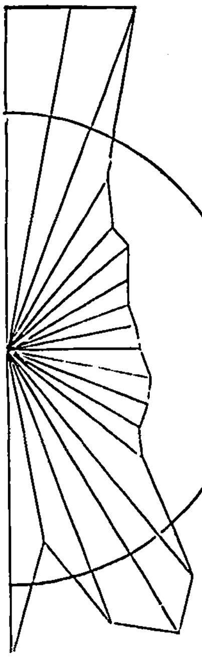


"CHRISTIANIA" GOVERNED BURNER.

Without Opal Globe.

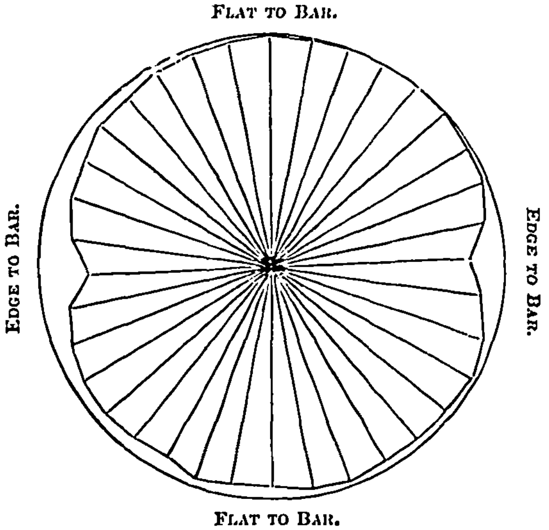


With Opal Globe.



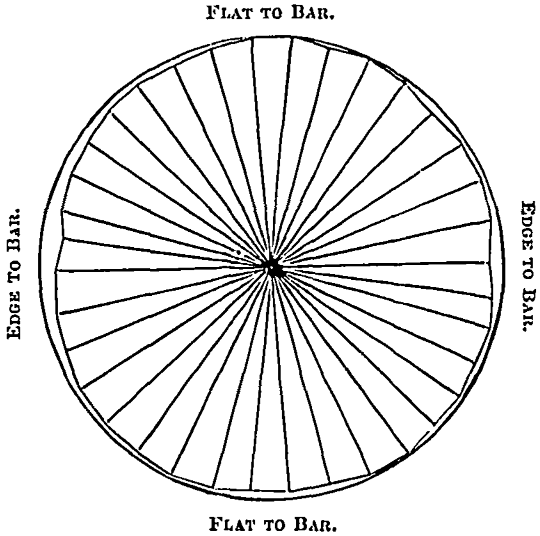
to put the question on a higher footing, and to consider that it should be looked at from all points of view. I therefore eliminate coal-gas from the list of desirable standard combustibles. Under these circumstances I submit that the only combustibles of a reliable character now in question are pentane and sperm oil. The pentane may be used in two forms, either as proposed by Mr. Harcourt, or as proposed by Mr. Methven. In the first instance, Mr. Harcourt, to whom the credit of the introduction of pentane as a standard combustible is due, uses it in the most economical manner, every particle of the

HORIZONTAL RAYS FROM FLAT FLAME BURNER No. 2, WITHOUT GLOBE.

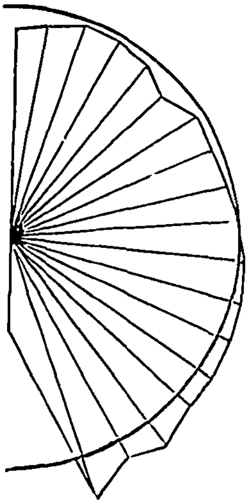


FLAT FLAME BURNER No. 3.

HORIZONTAL RAYS.

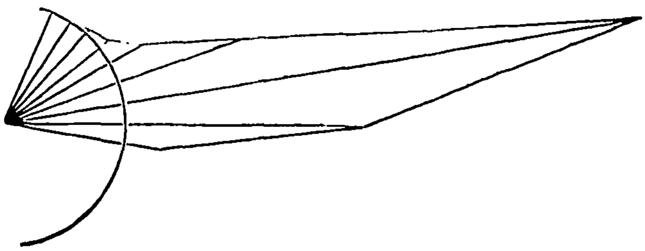


ANGULAR RAYS.

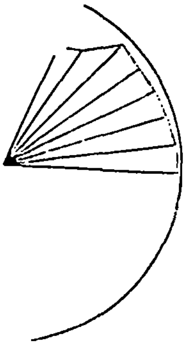


COMPOUND REFLECTOR, WITH No. 4 UNION BURNER.

ANGULAR RAYS.



THE SAME BURNER WITHOUT REFLECTOR.



substance being made to do effective work. In the second instance Mr. Methven uses it in a most extravagant form, utilising only a very small portion of the quantity actually employed. If used with the "Ten-candle Test" of Mr. Sugg, as I have suggested, it would be consumed nearly as rapidly as in Mr. Methven's arrangement, but nearly the whole of it would be made to do effective work. The sperm oil can only be used in the manner proposed by the late Mr. Keates.

These considerations, if generally accepted, narrow the question materially, and so afford hope that the day is not far distant when all differences will be reconciled, and one system universally adopted.

Before the question is finally settled, it is most sincerely to be hoped that the recommendation of the Congress of Electricians, which met in Paris in 1881, will be acted upon in some form, and the question made international. The matter has been under the consideration of a committee appointed by the British Association, but up to the present their efforts do not appear to have met with much success.

The following extracts from M. Monnier's "Étude sur les Étalons Photometriques" form such a valuable contribution to the subject, that I feel that little apology is needed for introducing them here :—

"On summing up the preceding determinations, one sees that one normal English candle consuming 120gr. of spermaceti per hour is equal to 0·120 normal carcel. One normal German candle of paraffin, of which the flame is 50mm. in height, is equal to 0·34 carcel. One normal candle of Munich consuming 10·4grm. of stearine per hour is equal to 0·153 carcel. One 'star' candle of five to the packet, consuming 10grm. of stearine per hour, and giving a flame of 52·5 millimetres, is equal to 0·136 carcel. One 'star' candle of six to the packet, under the same conditions, is equal to 0·132 carcel. The value of the normal carcel consuming 42grm. of oil per hour is therefore equal to 8·3 English spermaceti candles; 7·5 German paraffin candles; 6·5 Munich stearine candles; 7·4 'star' stearine candles of five to the packet; 7·6 'star' stearine candles of six to the packet. The gas of which 105 litres equals one carcel is equal to 13·2 candles by the English system, and to 14·5 candles by that of Berlin.

"We need not insist on the difficulties that one meets with when comparing the results of first experiments with such variable units, more than on the uncertainty which is attached to the relative value of different standards of light. . . .

"One sees that the system proposed by Mr. Harcourt for representing a luminous standard constitutes an interesting progress towards photometrical measurements, and if the principle of this method were generally adopted, it would be easy to establish experimentally a standard burner representing a definite power of light. This we have done for the use of the laboratory by regulating the burner to a tenth of a carcel, in order to simplify the calculations. But as it would be very important that a work of this nature, for its conclusion, should have the unification of photometric measures, it is to be desired that the experiments to be made in this direction should be undertaken with the assistance of experts who have specially devoted themselves to this question in England and Germany, as well as in France. We should perhaps in this way arrive at the realisation of an international standard of light, the use of which would permit us to arrange and express, in a language understood by all, the result of the researches made in the different countries."

From the results of my experience during the past six months, I am strongly of opinion that the only way to obtain results of a strictly comparative character would be to make an extended series of tests with the proposed standards on a four-way photometer, by which means one central light would be tested simultaneously by four different standards. It would be highly desirable that the observations should be conducted by as many competent photometrists as possible, each of whom should have considerable preliminary practice with all the standards to be tried; as however competent an observer may be with a standard with which he is acquainted, he cannot possibly be expected to obtain the best results with an entirely novel apparatus. The desirability of this latter proposition is strikingly shown by the results of the tests made by M. Monnier with the English candle, the results obtained by that gentleman being evidently of an exceptional character. M. Monnier states that the normal carcel is equal to 8·3 English spermaceti candles, whereas, as I have stated, Mr. Sugg in 1870 made it equal to 9·6 candles, and I have recently found it to be equal to 9·41 candles. The wide divergence of M. Monnier's results from those of Mr. Sugg and myself, is only another powerful argument for the speedy settlement of the question.

In submitting these general conclusions and suggestions to the Society, I have not thought it desirable to encumber the question with tabulated statements of the results of numerous experiments, but I have rather desired to deal with the subject from a broader point of view—with general considerations instead of minute differences. It is most sincerely to be hoped that experts and inventors will dismiss all personal rivalry and join in a combined effort for effecting that which all admit to be so desirable. I would most earnestly plead with all to abstain from anything which might convey a personal reference beyond matters of fact. I am sorry to have noticed remarks which can never contribute one iota to the solution of a question of so pre-eminently difficult a kind as that of the standards of light. For my own part I have deemed it but just to the memory of one who is with us no longer, to put his proposal clearly before the public; I refer to the Keates lamp, and in doing so I have only discharged that which I felt to be a duty. Whatever may be the results of future work in this direction, I shall endeavour, as I have done in the past, to obtain undoubted evidence of the truth, and to uphold that standard which prolonged experiments shall show to be most trustworthy in all respects. Whether this standard be one of those now proposed, or some future device, is a matter of perfect indifference to myself, as I hope it is to others. The question is an international one, and if settled upon a broad and permanent basis, it will be lasting, and a credit in future ages to the present time.

Note.—Since the date of the above paper, the author has been instructed by the Metropolitan Board of Works to carry out a further series of experiments by means of a four-way photometer as recommended by him.

DISCUSSION.

The CHAIRMAN said they had to thank Mr. Dibdin for a most interesting and suggestive lecture on two very important subjects. The first part of the lecture, dealing with the use of the radial photometer in studying the distribution of light, appeared to him to be one which all would do well to pay more attention to, and particularly those who had the arrangement of lighting specially large buildings. As a rule, the great object of lighting a large building seemed to be to provide that the greatest possible amount of light should be thrown into the eyes of the unfortunate audience, and as much as possible introduced between them and the speaker or musician they were listening to. If this was what was wanted, the arrangements approached nearly to absolute perfection. It seemed to him that the very simple idea of a radial photometer was the only method by which these common mistakes in the arrangement of lights could be avoided. Of course, if for private study people liked to have the light in their eyes no one could object; but he thought, even from a very little study of the elementary principles of how light fell—nothing near so perfect as Mr. Dibdin had given—people might save their eyes a great deal of weariness. One point which all would do well to bear in mind was that the eye was not a photometer, or rather that it was too perfect a photometer. The effect of a certain limited amount of bright light in closing the iris was most extraordinary; and very often the exceedingly dogmatic opinions which were heard as to the perfection or imperfection of particular lights, depended more on the question of whether the light was so arranged as to act upon the iris or not, as to any other cause. The light full in one's eyes contracted the iris, and diminished the amount of light falling on the retina from a less brilliantly illuminated surface. The question of the photometric standards was very interesting, and had several very important bearings. The mere question of whether gas was or was not an exact standard was only one detail. When we come to consider the relative advantages of different systems of lighting, or the relative value of different illuminating substances, this question was of the first importance; and it was only by such careful and accurate work as Mr. Dibdin had described that a conclusion could be arrived at.

Mr. VERNON HARCOURT said the radial photometer was really most admirably contrived, and calculated to do excellent service, and the determinations it afforded were very well illustrated by the length of the rays on the diagrams which had been shown, which brought before one, almost for the first time, a clear idea of the effects of shades and globes with which they had been so long familiar. Although he knew the effect of putting a shade over a lamp must be to throw more light downwards, and to diminish the amount of light spreading horizontally, he had never represented that effect to himself quantitatively, and could not have gained so clear an idea of it as he had gathered from Mr. Dibdin's diagrams. With reference to the standard of light, the point of greatest importance was that an effort should be made to have this question further investigated; and also that there should be some prospect of definite action being taken in the matter. The only reason, as far as he knew, for retaining the sperm candle in its present position was that it was specified as the standard by Act of Parliament, and must be continued to be used for the official business of gas testing until some change was made in the law. The Board of Trade instituted an inquiry some years ago, when a report was made to them, but, for some cause or other, no action had been taken upon it. He believed the reason was that which had stopped many more important matters—the exceeding difficulty of getting any measure through Parliament if there were any likelihood of opposition to it. Unless not only gas consumers, but gas companies also, were convinced that a change of standard was desirable, there was no likelihood of a Bill being brought forward on the subject which would pass through Parliament. Still, it was a most unsatisfactory state of things that they should be bound to use a standard of a most unscientific and unsatisfactory character, simply because it was connected with a large industry which had been established by law, and because there was great difficulty in getting the law changed. He hardly liked to speak of the demerits of the candle; but all who had had to do with photometry must be aware that their best efforts were wasted in attempting to obtain exact results with candles. All the rest of their apparatus might be of a very perfect character, but so long as the standard with which other lights were compared was continually and miserably fluctuating whilst in use, the results could not be in any way satisfactory. It was wonderful that testing should be constantly going on with the object of seeing that the gas was up to the standard, and that men were working carefully and conscientiously at it, when they could not but have learnt quite early that their best endeavours were futile, and that the figures they were obliged to send in represented very little indeed. He hardly liked to enter on the question of the general merits of the various standards, as he was particularly interested in one of them; but he might say that until Mr. Dibdin's recent work was published he had no idea how excellently constant a light could be obtained from such a lamp as that which Mr. Keates had devised. He had formerly been prejudiced against standards in which the use of a wick was involved, because it would seem that variations in the plaiting of the wick, and variations arising from the difference in the length of time which had elapsed since the lamp was trimmed, together with small variations in the structure of the lamp, or position of the chimney, would lead to considerable variations in the amount of light it gave; but all such anticipations must yield to the facts of the testings Mr. Dibdin had recently produced, and reported to the Metropolitan Board, which showed that though these variations might occur, and the light might vary considerably, yet, by making a simple proportional correction for the amount of sperm oil consumed in the lamp, and assuming the amount of light given was directly proportional to the amount of oil consumed, and making the comparison between the corrected light and another flame from stored coal gas, it was evident that the light given to the lamp when the corrections were applied was of very great constancy. He was, therefore, fully convinced that this lamp deserved to take a high place amongst standards.

Mr. METHVEN said he was fully alive to the importance of the idea suggested by Mr. Dibdin of the desirability of having these standards more carefully and closely investigated; and it would be a grand thing when a standard was introduced which would put the sperm candle on one side altogether. With reference to Mr. Dibdin's recent experiments, he desired to refer especially to the results obtained by different operators. They could not but notice, in following the figures given by Mr. Dibdin, the great difference in the results arrived at by different operators; and this, he thought, was a very important point. His conviction was that the difference in results might arise in consequence of the different photometers with which they worked; and he was strongly of opinion that, before the question of a new photometer could be determined, it was absolutely necessary that some investigations should take place with reference to photometers themselves. He thought these differences obtained by different operators were in great part, if not entirely due to the disc which was at present generally used; and that if a little attention were devoted to this subject a better form might easily be introduced. He had been considering this question lately, but his investigations had not been extended sufficiently to warrant him in coming to any definite opinion. His impression was that much better results would be obtained if, instead of judging of the illumination of an opaque spot in the centre of a greased paper, they had the opportunity of determining the depth of a transmitted shadow. He placed a piece of blackened tin at the same distance from the disc on either side—there being two pieces of tin on one side of the disc and one on the other—in order that the two shadows should not be thrown upon one another; and he found very great facility in determining the exact position of the discs by means of these transmitted shadows. It was much easier to arrive at the correct position of the disc by this means. When it was remembered that shifting the position of the disc 0·1 inch made a difference in the readings of 1½ per cent., it showed how carefully this point should be considered when the time arrived for the different standards to be investigated. If the operator had the screen obscured from his vision, he would have great difficulty in bringing the disc in half-a-dozen readings within 2-10ths of the actual position. This brought him to another point of great advantage likely to be derived from a high-power standard. In using such a standard the disc was brought down into the wider space, and the distance of 0·1 inch or even a ¼ of an inch made very little difference in the result of the readings. This led him to consider the question of another form of photometer; and at present he was engaged on some experiments with one in which the standard and the disc were fixtures, and the light to be tested was movable. In a photometer of the ordinary length of the Letheby photometers—60 inches—he found the difference of the point on the bar of fifteen or sixteen candles was about 1½ inch. This 1½ inch divided into tenths of a candle was a perceptible distance, and he maintained that 0·1 inch, in the difference of light under those circumstances, would not make any serious difference. On the other hand, the distance upon the bar between fifteen and sixteen candle gas, on a 75-inch photometer, was only about half-an-inch, and the difference of 0·1 inch in placing the disc would make a difference of 1½ per cent. in the readings. Of course with a 60, 50, or 40 inch photometer the distance decreased, and a difference of 0·1 inch became very serious. He suggested having the standard and disc fixed, and the light to be tested movable. With a photometer of this kind you could measure 500 candles, or even an electric light, if you had provisions for taking it far enough away, the standard remaining constant all the time.

Professor Foster was very pleased to hear that Mr. Dibdin was continuing these investigations, particularly with regard to the reflection of surfaces, which was a subject of great importance at the present time, because extraordinary statements were made in the public press respecting the illuminating power of new lamps which were brought out from time to time. In many of the recuperative forms of lamps there was a reflector as well as the recuperating influence at work; and, before you could arrive at any scientific figures relating to recuperation as applied to illumination of the amount of light gained by reflection ought to be eliminated. He was referring to a number of lamps, which were familiar to gas engineers, in which the reflecting surface formed part of the lamp, and had a very marked effect; but the manufacturers dealt with the whole thing as a lump sum, showing the enormous amount of lighting power in a particular direction, not saying a word as to what reflection was doing, and what the true lighting power of the lamp might be. This was very important in considering special reflecting metallic surfaces made for a particular occasion, which might only last for that time, but would not do so much longer. With regard to the question of standards he was almost afraid to say anything on behalf of candles; but he might remark that the first time he contributed anything to the *Chemical News* was in 1870, and it was with reference to sperm candles. There was an old proverb to the effect that threatened men live long; and he feared that the extraordinarily strong feeling in certain directions for a particular standard, only made the prospect of the life of the sperm candle still more favourable. It was extraordinary that something was not done to improve these candles. He did not know whether they were at all defined, but, if so, very little care was taken in their manufacture, so far as knowing the actual composition of the material, or the conditions of the manufacture. All were impressed with the importance of having a standard which could be produced under stated conditions. The air-gas standard was of this class; but still it was limited in many instances. They wanted a portable standard; and, for such purposes, the Keates lamp might be a very important function. Another important point was not to allow a great disparity to exist between the thing measured and the standard; and this seemed to have been overlooked in many instances. In dealing with large lamps, such as those of Sir James Douglas or of Mr. Siemens, a candle could scarcely be taken as a standard; in such a case the errors of observation became very marked, and, therefore, as a principle, there should be some comparison between the amount of light to be measured and the unit employed. The candle lamps devised by Mr. Harcourt might be admirable for measuring the gas in general use; but it would be very difficult to work with the standard for other special and technical purposes.

Mr. Hartley thought Mr. Dibdin must have said more than he intended when he said that, anterior to these testings, there had been no estimation of the amount of light at different angles. In his own vindication he must say that in the year 1881 he published a series of three articles in the *Journal of Gas Lighting*,* one of which was especially devoted to the effects produced in the measurement of light at different angles. The difference between the measurements, then, and those of Mr Dibdin consisted in this, that, wanting himself to know the difference in effect produced in lighting a vertical surface, he used a vertical screen, but, nevertheless, he had a photometer which enabled him to measure the amount of light from flames at any imaginable angle above the discs. Mr. Dibdin had gone a little in another direction, and was able to estimate the value of light coming upwards to the disc; but, as most of the lights in use were above the level of the eye, the most important determination was certainly that which dealt with an overhead flame. In ordinary estimations of light power, the light was measured horizontally, as when gas was tested for its illuminating power. At the same time he (Mr. Hartley) cited some experiments showing the effects obtained by reflectors of different forms, and gave illustrations of their effects. He then remarked that the screens placed in the base of an Argand flame generally made the light more soft and agreeable; but that the use of a reflector above cut off a tremendous amount of light. Again, he said, for the general lighting of rooms and offices, reflectors should be made so as to deliver the rays in a manner analogous to that which Mr. Dibdin had depicted. He claimed, therefore, the merit of having directed special attention to the necessity for measuring flames in various ways; and, in the same paper, drew attention to the fact, which did not seem to have been observed before, that, in dealing with flames at different elevations, it was very necessary that the angle should be regarded. Referring to the amount of light indicated in different directions by different burners, he said the diagrams were very beautiful; but the fact was known as far back, he believed, as 1856, to Mr. F. J. Evans, who made the first experiments with respect to flat-flame burners, and who announced that the edge of the flame yielded less light than the side. Since that time a number of others had observed the same thing. In 1881 he made a large number of tests with paraffin lamps, in which he referred to the effects produced from the flat sides and the edges. In this respect he differed from Dr. Redwood and his son; because he found the difference less than they did; and, although a gas man, he was quite ready to render justice to the lamps which he tried. Coming now to the various standards of light, he had been associated with Mr. Heisch in testing the standards under the authority of "The Gas Institute," and both of them, though most unwillingly, felt compelled to say something adverse to Mr. Harcourt's pentane standard. Mr. Dibdin had, during the evening, tried an experiment, with the view of showing that the Harcourt air-gas was not subject to vibration; but he should remark that, in their report, Mr. Harcourt and himself drew a distinction between the two kinds of standards—*the lamp standard and the air-gas standard*—and stated that it was the lamp standard which was specially subject to vibration. The lamp was now presented in a different form to that which they experimented with. It had then no top chimney, only one at the base; and the consequence was that it simply directed an upward current of air to the flame, which was more liable to vibration. M. Mourier, in testing candles, found the French lamp equal to about 8½ candles; but Mr. Sugg and himself made it 9½, and Mr. Dibdin 9·4, so that there seemed some difference in the usage of candles, or, perhaps, candles gave more light now than they formerly did. He had not had an opportunity of trying the Keates lamp at the time he was invited to do so; and afterwards he was not able to use it. He was surprised to find, in respect of the Methven standard, that, while Mr. Dibdin said it showed considerable variations, he found that, with a cut-off flame, which, after all, was little more than the Methven standard in another form, he got constant light. The Keates lamp was used with a cut-off flame; and, taking the Methven screen out, they were told that it would give a light of four or five candles at will. Now, if one flame could do it, why not another? Certainly the flame varied to some extent with the quality of the material burnt. But it had been proved that the quality of the material might differ to a very large extent; for it was shown by the Board of Trade investigations some years ago, that at least the difference of two or three candles might be caused by gas of different qualities, and yet the same light was yielded through the modern slot. He was decidedly at issue with those who advocated a high-power standard. He found it much more comfortable to use a comparatively low power than to use a high one, the effect on the eyes being less powerful. Again, it was a question whether with a high power the eye was not satisfied much more easily than with a low power; and, therefore, differences, which might exist, were not so easily discoverable. It was easy to weigh tons, but comparatively difficult to weight fractions of a milligramme, and it seemed to him that the same thing held good with respect to photometry. Differences were really found when standards of comparatively low power were used, which were undiscoverable with standards of high power. This consumption would apply to what Mr. Methven had said with regard to the advantages of wide spaces. This question would, no doubt, in the end be settled under the *direction of a Parliamentary* Committee, when all those interested in the matter would be called together. It was certain that, up to the present time, there was no bitter antagonism on the part of any of the operators engaged in these investigations. They were all anxious to arrive at the truth; but circumstances rendered the determination difficult, if not impossible, but when they all got together, they might, perhaps, arrive at it. Mr. Foster had touched on the question of reflection, and he also wished to emphasise the importance of this matter; and, when burners were being tested, it had been specifically stated when reflecting surfaces were used, and it had also generally been shown what the effect of these surfaces was within a certain area. Mr. Foster was certainly right in saying that there ought to be specific statements as to the effect of reflectors.

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* See "Observations on Glass, as an Obstructor and Reflector of Artificial Light," by Mr. F. W. Hartley, A.I.C.E.; and *Journal of Gas Lighting*, Vol. xxxvii. pp. 51, 91, 130.

Dr. Perkin said he was not specially conversant with this matter; but, in working a polariscope, he had found that when the light was very strong there was a difficulty in getting accurate readings, and if it were very weak it was very trying to the eyes. He should therefore think the happy medium was the thing to be aimed at in most cases where the eyes were used.

Dr. Percy Frankland said it seemed to him that photometric observations with reflectors must be considerably misleading, unless the precise circumstances of the case were always given; because with certain kinds of reflectors you would get an entirely different observation according to the length of the photometer. If the source of light were placed at different distances from the screen, that would give entirely different readings to what it would if placed at another distance. The length of the photometer, in fact, was the actual factor in the determination. In all cases where burners were tested the reflectors should be discarded altogether, and special statements made with regard to the effect of particular reflectors which were recommended. With regard to the standard of light, he had generally used candles and a Methven screen, but it seemed to him a very important matter to have a standard of light at any rate approximately equivalent to the light to be tested. This was really a mathematical question. It was evident that when the source of light and the standard were nearly equal, any deviation between them would give readings very much larger than in the opposite case. It was like making an analysis with a large quantity of the substance: and they all knew how much more accurate the results were when the quantity of the substance employed was large than when it was very small. Of course, there was also the question which was most agreeable to the eye; and there could be no doubt there was a certain happy medium in that matter. You could not for a long period of time look at a source of light like a Keates lamp with the same comfort that you could look at the standard candles or the Methven screen. With regard to Sugg's ten-candle standard, he was much interested to hear that the light remained the same in spite of changes in the richness of the flame. He had had occasion, recently, to take the illuminating power of gases of great richness, and when doing so had been struck by the large space of blue flame at the base when burned in the ordinary Argand burner; but he had not been prepared to hear that this increase in the blue portion of the flame was so exactly in proportion to the richness of the gas.

Mr. Whitley Williams exhibited a lamp to which his attention had been drawn by Mr. Frederick Siemens, having been devised by Dr. Von Hefner Altneck, for the purpose of measuring the electric light. It possessed many of the advantages of Mr. Vernon Harcourt's pentane standard, but, in some respects, it was much more simple. It was essential, with a photometric standard, that the substance burnt should be of absolutely definite composition; and it was equally requisite that the amount of light given by it should be in exact proportion to the amount of substance burnt. In this case a sufficiently complete and extensive series of experiments had not yet been made to demonstrate this completely, but he had seen enough to be able to say that the light was an extremely good one—in fact, enormously better than that given by standard candles. These candles had been almost universally condemned, but it had always appeared to him remarkable that although enormous pains were taken with the apparatus, very little pains should be taken to control the standards they had to use. He had been obliged to reject more than one-third of the candles supplied to him, and one which he had brought with him was utterly unfit for use, the wick being out of the middle of the candle. It seemed to him rather remarkable that, whilst they were compelled by Parliament to use these candles as the standards, there were no conditions imposed as to the way in which the candles should be made. A great deal also depended on the way in which the candles were burnt. This lamp was made to burn amyl acetate. A tube of German silver, of a given thickness and diameter, was inserted in the lamp, and the thickness and construction of the wick did not materially matter. The flame was regulated to the height of two pointers, and could be very easily adjusted. After about ten minutes' burning the flame remained constant for eight hours with hardly a shade of difference, and when it had burned for this time the wick itself showed no signs of charring. That arose from the fact that the boiling point of amyl acetate was enormously below that at which the wick even began to be charred, or browned, and in that respect, at all events, the lamp was an admirable one. It was not by any means absolutely necessary that the amyl acetate should be particularly pure. If butyl acetate was taken, the next lower homologue of the series, the amount of light given out by the lamp was ·99 of that given when pure amyl acetate was used. He had suggested to Mr. Siemens that the lamp should be made simpler, as it now weighed nearly 1 kilo., and he believed it might then be made very serviceable. Dr. Von Altneck was very anxious to correlate this with the English candle in use, and he found that by adjusting the height of the flame to about 40mm. from the edge of the metallic tube the light was almost exactly equal to English sperm candles. He had used this from time to time in the intervals of testing the gas of the Metropolis, and the results very fairly agreed. He found one reading always came within 1½ per cent. of the mean of 300 tests.

Mr. Dibdin, in reply to Mr. Methven, said the differences observed by different operators were not due to their having used different photometers, the tests to which he referred having all been made on one photometer and one disc. Mr. Hartley seemed to think he was under the impression that no photometer had been used for testing angular rays previous to the introduction of the radial photometer. It was quite true that Mr. Hartley made some tests in 1881, but they were made on the vertical disc; and he had before pointed out to the Society, and might point out once more, how important the position of the disc was. If the light were above the vertical disc, the horizontal rays would have no value. It was Mr. Hartley's "Universal" photometer, as altered by Professor Foster and himself, which led to the present form. He had not the slightest doubt that, as Mr. Hartley had said, the difference between the light given by the edge and flat side of a flame had been proved before; but he thought it would be interesting to make some further tests for his information, if not for others. He did not claim any special merit or novelty in that matter. He hoped the time would soon come when Mr. Hartley would be able to make tests with the Keates lamp. He should remark, however, that the Keates lamp with a screen was not the lamp as devised by Mr. Keates, which was a 16-candle lamp. The screen was a suggestion of Mr. Sugg's; but he (Mr. Dibdin) did not much approve of it, although he believed it had been found to give very good results. Variations in the character of the flame, which was not of any importance when the total consumption of oil was taken into account and the corrections made, were very serious when only a small portion of the flame was taken, and no correction made for the consumption of oil. Dr. Percy Frankland had pointed out a very important matter in connection with reflectors. It was, no doubt, necessary, in all such cases, that the length of the photometer bar should be taken into account; and, in any comparative experiments with different screens, the same length should be used in all cases. It would be ridiculous to test one reflector on a 50-in. bar, and another on a 200-in. bar. What he claimed for the radial photometer was that it gave the opportunity of testing to every degree; but, in the diagram showing the effects of the compound reflector, he had only taken one or two points to give the general effect, showing whether the maximum light was up, down, horizontal, or in what direction. In regard to a powerful flame being very trying to the eyes, it, no doubt, was so, if the operator were foolish enough to stare at the light. But, in making photometric observations the operator only looked at the light occasionally to see if it was burning properly, and then he should only do so through coloured glass. The observer could not read the disc properly if he looked at the light. The eye should be carefully shaded in every way, and operators who were not careful about this matter would never get reliable results.

The Chairman then proposed a vote of thanks to Mr. Dibdin, which was carried unanimously, and before the proceedings terminated, the latter gentleman showed and explained the action of the radial photometer.

Liverpool Section.

Chairman: E. K. Muspratt.

Vice-Chairman: J. Campbell Brown.

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Ernest V. Bibby.
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F. Hurter.
H. Brunner.
A. Norman Tate.
J. Affleck.

Local Sec.: E. G. Ballard, Queen's Park, St. Helens.

Notices of papers and communications for the meetings to be sent to the Local Secretary.

Manchester Section.

Chairman: Sir H. E. Roscoe.
Vice-Chairman: D. B. Hewitt.
Committee:
R. F. Carpenter.
C. Estcourt.
H. Grimshaw.
Peter Hart.
J. von Hohenhausen.
T. Jackson.
J. Knowles.
I. Levinstein.
C. Schorlemmer.
Watson Smith.
Wm. Thomson.
D. Watson.
Local Secretary:
J. Carter-Bell, Bankfield, The Cliff, Higher Broughton, Manchester.

Notices of papers and communications for the meetings to be sent to the Local Secretary.

Meeting held Tuesday, March 24, 1885.

SIR HENRY ROSCOE IN THE CHAIR.

ON THE ESTIMATION OF TANNIN.

BY BERTRAM HUNT.

In the following memoir I propose giving a modification of the method of estimating tannin by permanganate. The modification consists in the method of precipitating the tannin previous to the titration for "matters oxidised other than tannin." Procter, (*Journ. Soc. Chem. Ind.* iii. p. 82), in order to precipitate the tannin, adds to 50cc. of the tannin solution 28·6cc. of gelatin solution and 10cc. of dilute sulphuric acid. He then saturates the liquid with salt, adds a little kaolin, and shakes thoroughly. He thus precipitates all the tannin, and almost all the gelatin present, and on filtering gets a clear bright filtrate. I have found, however, that in order to get a clear, tannin-free filtrate, it is unnecessary to saturate the liquid with salt, and that, in the case of materials containing any considerable quantity of gallic acid, the results are too high owing to the precipitation of some of the gallic acid. The following method gives a liquid which filters easily, and the filtrate is perfectly clear, and free from tannin. 50cc. of the tannin solution are run into a small dry flask; to this 25cc. of a fresh filtered solution of gelatin (2grm. per 100cc.) are added, and the flask shaken. 25cc. of a saturated solution of common salt, containing 50cc. of strong sulphuric acid per litre, are now added, and about a teaspoonful of pure kaolin or baric sulphate. The flask is now thoroughly shaken for a few minutes. The solution filters easily and quickly, and the filtrate is clear and bright.

In order to compare the two methods, the following experiments were made:—A solution of "pure tannin" was made of a strength of 10grm. per litre. On analysis this solution gave, by Procter's method, 0·8940grm., and by the modified method 0·8937grm. tannin per 100cc. These numbers are calculated on the supposition that 63grm. oxalic acid = 41·57grm. gallotannin. To 9 volumes of this solution was added 1 volume of a solution of 10grm. gallic acid in 1 litre water. On analysis, this second solution gave, by Procter's method, 0·8176grm., and by the modified method, 0·7956grm. tannin per 100cc. To 8 volumes of the tannin solution were now added 2 volumes of gallic acid solution. The resulting solution gave, by Procter's method, 0·7399grm., and by the modified method, 0·7111grm. per tannin per 100cc. These results prove, I think, the precipitation of gallic acid along with tannin in Procter's process, and the following results confirm it. A solution of 5grm. gallic acid per litre water was made. On going through the process of precipitating tannin by Procter's method with 50cc. of this solution, it was found that 18·48 per cent. of the gallic acid was precipitated, while by the modified method only 3·18 per cent. was precipitated. When the gallic acid solution was of a strength of 1grm. per litre, by Procter's method, 17 per cent. was still precipitated, and by the modified process only traces.

As regards the titrations with permanganate, the method of working recommended by Procter gives perfectly satisfactory results. With practice, results of duplicate titrations, agreeing to ·05cc., can always be obtained.

A good method of extracting the material to be tested, is to weigh out an amount of substance rather less than 20grm., extract by boiling half-an-hour or so with about a litre of water, wash and make up the clear cold solution to a strength corresponding to 10grm. per litre. For the estimation of the "total matters oxidised by permanganate," it will be found that, if some of the solution of above strength be diluted 10 times, 10cc. will be a convenient quantity to titrate along with 20cc. of indigo solution. For the estimation of "matters other than tannin," if the material contains more than 45 per cent. of tannin, it is advisable to take only 25cc. instead of 50cc. of the tannin solution, and 50cc. instead of 25cc. of the saturated solution of salt, the amount of gelatin solution added being the same (25cc.). The gelatin solution must, in all cases, be freshly prepared and filtered.

In the case of gambier and allied materials, precipitation by gelatin and salt does not remove from solution all that is of "tanning value," as the following experiment shows:—200grm. cube gambier were shaken till dissolved in a litre of water at 60° C. The solution was then allowed to stand 24 hours, and the clear liquid syphoned off. The sediment was stirred up with some cold water, and again left to settle. This treatment was repeated till the clear liquid gave no precipitate with gelatin. 100cc. of the clear liquid were then placed in contact with 5grm. of "pure dry skin." By titrating the liquid with permanganate before and after contact with the skin, it was found that 68·66 per cent. of the "matters oxidised by permanganate, as oxalic acid" had been absorbed by the skin. The best substance for abstracting the tannin from solution in the case of this material is pure dry skin shavings or powder; and if the skin be prepared in the following manner, constant and concordant results can be got:—Selected pieces of pelt, as they come from the "bate," and are ready for the tanpit, are freed from adhering flesh, and soaked for an hour or so in water slightly acidulated with acetic acid. The pieces of pelt are then thoroughly washed with frequently changed quantities of distilled water till free from acid. They are then soaked for 24 hours in clean methylated spirits. After squeezing, they are soaked in "alcohol distilled over lime" for another 24 hours. The pieces are now dried thoroughly at a low temperature, and brought to a state of fine division by planing or otherwise. To perform an analysis 5·6grm. of the dry pelt are put into a small flask, with about 100cc. of the gambier solution, containing 10grm. gambier per litre. The solution is kept in contact with the pelt for at least 12 hours, and the pelt then filtered off. The filtrate is then titrated for "matters other than tannin" in the usual way.

As there appear to be few reliable analyses of tanning materials by the permanganate method published, I give below some results got by me in testing different materials. The tannin was estimated both by Procter's method and by the modification described in this paper. Both methods were worked simultaneously with the same solution of the respective tanning material, so that the results are strictly comparable. The filtrates from the gelatin precipitates were in every instance tested for tannin, but in no instance was any found. They were also tested for gallic acid by potassic cyanide solution (S. Young, *Chem. News*, 48, 1234, p. 31), and in the case of those materials containing a relatively large amount of "matters oxidised other than tannin," the colouration, in equal bulks of solution, was distinctly less intense in that from which the tannin had been precipitated by Procter's method than in the other.

On referring to the following table of analyses, it will be observed that the difference in the percentage of tannin found by the two methods is greatest in the case of those materials containing a relatively large amount of "matters other than tannin oxidised by permanganate."

The "total extract" in the following table was determined by evaporating a portion of the tannin solution to dryness in a small porcelain basin and drying the residue at 110° C. The "insoluble matter" was also dried at 110° C.

DISCUSSION.

The CHAIRMAN: You are all aware that there are considerable difficulties in the determination of these very important substances. The subject has already received the attention of our Society in a paper which was read by Mr. Procter before the Newcastle Section, and which is published in our Journal. Mr. Hunt's method seems to be an improvement on Mr. Procter's, and I hope it is a method which can be entirely relied upon.

In reply to several questions by the Chairman, Mr. HUNT said: Gambier and similar materials contain a large proportion of "catechin" or similar bodies which are not precipitated by gelatin, but are of tannin value as they are absorbed by skin. It is true that these bodies are precipitated almost completely by the addition of salt and acid to the solution, but matters of no tannin value are also

NAME OF MATERIAL.	Total matters oxidised by Permanganate, as Oxalic Acid.	Tannin (Procter), as Oxalic Acid.	Tannin, as Oxalic Acid.	Total Extract.	Insoluble.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
English Oak Bark	15·70	13·51	11·97	18·38	66·15
Canadian Hemlock Bark	9·03	7·16	7·03	13·96	75·25
Larch Bark	8·20	7·17	6·15	20·64	60·80
Mangrove Bark	31·35	29·71	28·48	26·60	49·70
Alder Bark	8·27	6·15	5·73	19·36	68·00
Blue Gum Bark	10·18	8·91	8·91	11·76	71·65
Valonia	37·41	35·21	30·50	38·50	46·05
Myrabolans	48·23	38·13	38·00	42·80	—
Sumach	42·53	31·30	31·16	41·10	47·77
Betel Nut	15·91	13·87	13·79	17·94	67·00
Turkish Blue Galls	73·28	65·83	59·96	48·40	36·35
Aleppo Galls	98·85	87·82	83·05	68 80	11·32
Wild Galls	26·21	18·75	16·56	31·70	51·17
Divi-Divi	66·98	62·62	61·22	51·38	29·90
Balsamocarpon (poor and old sample)	50·49	37·76	32·88	57·14	28·25
Pomegranate Rind	27·58	21·18	23·12	41·00	49·50
Tormentil Root	22·27	20·93	20·68	19·70	67·95
Rhatany Root	22·27	20·15	19·30	18·80	66·00
Pure Indian Tea	23·06	18·05	17·40	31·16	53·40
Pure China Tea	18·03	11·21	11·09	21·50	62·60
Cutch	57·65	51·95	44 21	61·60	4·75
Gum Kino	66·39	59·55	51·55	79·30	1·00
Hemlock Extract	35·16	33·17	30·98	48·78	—
Oakwood Extract	33·49	26·00	23·86	37·78	—
Chestnut Extract	39·77	32·63	26·88	50·28	—
Quebracho Extract	48·22	44·15	40·81	49·00	—
"Pure Tannin"	135·76	122·44	121·93	—	—
Tan Liquor, sp. gr. 1·030	4·81	3·44	2·10	6·01	—
Spent Tan Liquor, sp. gr. 1·0165	1·40	0·37	0·25	3·10	—
			Absorbed by Dry Pure Skin.		
Gambier, Cubo	70·12		51·07	74·40	5·31
" Sarawak	63·13		47·09	70·70	3·07
" Balo	56·00		43·70	63·54	1·40

precipitated. Skin does not thoroughly absorb tannin, at least in many cases it would take fully twenty-four hours. In the case of gambier it is absorbed very quickly.

Mr. Grimshaw: Although I have not been able myself to do much in the way of research upon the estimation of tannin materials, I have had at times a number of such analyses to conduct, and have almost always adopted Mr. Procter's modification of Löwenthal's method. I have certainly found that something interfered with satisfactory results being obtained, but it did not occur to me that this was owing to the different quantity of salt used. I should like to ask Mr. Hunt two questions in relation to tannin materials. The first is as to whether he has made any experiments with regard to ascertaining if there is much difference between the results which he gets when the tannin is abstracted by skin or similar material, and by re-drying and weighing the horn, skin, or pelt itself? Of course we are not properly acquainted with all the materials which are taken up in the process of tannin, and it would therefore be of great interest and value to compare the valuation of the material by chemical analysis with that represented by the increased weight of the skin itself. The second question I should like to ask is whether Mr. Hunt could give us a little information as to how he selects and prepares the indigo which he uses as an indicator? Of course it is pretty well known that certain descriptions of indigo are not equally suitable for showing the point at which oxidation is finished. Some samples you may take, particularly those which give a brownish shade, interfere with the determination, and I find it difficult to get an indigo which will act satisfactorily in showing the end of the oxidation of the tannin materials.

Mr. Hunt: As regards the first question, I have made a series of experiments, and have found in many instances the results agreed very well. Procter's results were always too high. In some instances the results by my method were lower, and in others slightly higher, than those got by absorbing the tannin with skin.

Mr. Grimshaw: There is also a method of forcing the liquor through one or more skins. It is a modification of Hammer's method, and was introduced by Müntz and Ramspacher with a special apparatus for the purpose.

Mr. Hunt: For most materials the method is perfectly useless. With some materials the skin only absorbs a portion of the tannin, as proved by Procter and others. Gambier is the only material for which this method is of any use at all. With regard to indigo, I get the best indigo carmine and dissolve it in hot water, and the strength I use is about 5grm. per litre, with 50cc. strong sulphuric acid, and this has given satisfactory results. You should test the indigo, and reject any that gives the brown colour with permanganate to such an extent as to interfere with the end reaction. Löwenthal, the originator of the permanganate process, used a solution of salt and gelatin to precipitate the tannin. Procter adds a solution of gelatin, then dilute acid, and then saturates the liquid with salt, and thus gets a liquid easily filtered. In my process I add gelatin solution to precipitate the tannin, and then a certain proportion of a saturated solution of salt containing acid, and thus get a liquid which filters as easily as by Procter's method, but the gallic acid present is not precipitated, or at any rate to a far less extent than in the case of Procter's method.

Mr. Siebold: I should like to ask Mr. Hunt whether in his determination the tannin alone is determined unaccompanied by colouring matter? I have made many determinations of this kind by means of gelatin without the addition of salt, and have always observed that a considerable portion of the colouring matters present in such substances as sumach, myrabolams, divi, valonias, galls, etc., are precipitated along with the tannin, while the filtrates from the gelatin precipitates appear comparatively colourless. When I worked with a solution of pure tannin, and then repeated the experiment with the addition of colouring matters free from tannin, there was always a notable difference in the result, more gelatin solution being required in the latter case than in the former. In the case of divi and similar substances rich in colouring matter, the amount of tannin thus found may be as much as 50 to 100 per cent. in excess of the actual proportion of pure tannin present. As already stated, I have never applied salt in these determinations, but have simply used a standardised gelatin solution containing a minute proportion of alum. The liability to error arising from colouring matters is, however, not confined to the gelatin process, but is shared by almost all the other technical methods for the estimation of tannin. I have obtained fairly accurate results by using organic alkaloids as precipitants; but this method may be objectionable on account of the expense. A good practical method of determining tannin in the various materials named remains, in my opinion, still a desideratum.

Mr. Hunt: In Procter's process the filtrate from the tannin and gelatin is nearly colourless. Alkaloids could not be used, as the results are too low. The precipitate of the alkaloids is slightly soluble, Neubauer having shown that even when excess of cinchonine was added the filtrate contained tannin.

The Chairman: Does your method give the results?

Mr. Hunt: The "permanganate value" of the tannin in each material is different. For instance, the tannin of gallnuts is quite different, as regards its action on permanganate, to that of oakbark. The tannin of sumach most nearly resembles gallo-tannin.

The Chairman: How can you compare them?

Mr. Hunt: I always give my results in terms of oxalic acid, as recommended by Procter. It is useless to try to compare the relative values of different tannin materials. It is only possible with certainty to compare different samples of the same material.

The Chairman: That seems to indicate an acknowledgment that the method does not apply to different materials.

Mr. Hunt: There is no method which does that.

Mr. Siebold: It is certain that all these methods estimate more than the tannin present, and that the results are therefore too high. I cannot endorse the unfavourable opinion expressed by Mr. Hunt relative to the alkaloid processes, and am inclined to think that the lower numbers obtained by them are less due to the solubility of the precipitates than to the greater freedom of the latter from colouring matters. For the purposes of the tanner, the gelatin process, as well as some of the other methods in common use, may perhaps be regarded as more satisfactory than for the purposes of the dyer and printer, inasmuch as the colouring matter which renders the tannin estimation too high passes into the leather along with the tannin. In fact a certain body of colour is desired by the tanner, and so long as this is not excessive and not of an unsuitable shade, it is a valuable constituent of the materials employed in tannin. It ought to be well understood that none of the analytical methods alluded to by Mr. Hunt will give the actual proportion of pure tannin; and that for this reason dyeing experiments will often give more valuable results than a chemical analysis.

Mr. **Hunt**: By my method there is less "extractive" precipitated than by Procter's. In Procter's method the complete saturation of the liquid with salt undoubtedly precipitates a considerable amount of "extractive" along with the tannin. In the method given to-night, as the tannin liquid is not saturated with salt, less "extractive" is precipitated with the tannin, though, of course, I cannot say for certain that tannin only is precipitated. It is unfortunate that I have been unable to give you in a large diagram the full list of analyses, which would, I think, have shown you the difference between the two methods. If there is no salt or acid added it would be almost impossible to filter the solution.

Mr. **Siebold**: The extent to which these colouring matters and vegetable extractives impair the result is much larger than is generally supposed. In some instances in which I ought to have found about 10 per cent. of tannin, the analysis showed double that amount and more, which shows at once how utterly unreliable these tests are when applied to such substances as I have before named.

Mr. **Hunt**: As regards the precipitation of colouring matters, do you use alum with the gelatin, and did you prove that alum had no part in the precipitation of the colouring matter?

Mr. **Siebold**: I feel satisfied that the precipitation of colouring matters by gelatin, to which I have repeatedly alluded, is not due to the small proportion of alum used in my experiments, but would occur equally just the same in its absence.

Mr. **Sansone**: I beg to endorse Mr. Siebold's remarks with regard to the ordinary methods of estimation of tannin not being reliable. I always use comparative methods, which are the only ones to be relied upon. First of all I ask myself what is the tannin to be used for? In the case of sumach, we know it is used by dyers, and we must have regard to the amount of work to be done. Suppose we take some cotton and prepare it with a solution of acetate of iron; we dry it and expose it to the air, and then by passing it through a whiting bath we complete the fixation of the oxide of iron on the fibre. Now, if we take a weighed quantity of this cotton and dye it in a bath containing tannic acid, we form a grey colour on the fibre. If we take two or three different samples which are treated in a similar manner, we can judge by the depth of shade which of the samples is the strongest; and if we take the different samples in relation to their price, we have at once a comparative method—that is, the sample which will give the deepest shade on the cotton prepared with iron will be the strongest. There is another plan which could be followed, and which also gives good results. If cotton be mordanted with different samples of tannic acid, which are to be tested and left over night in the bath, then next *morning* passed through a bath of tartar emetic and washing, we have here several patterns which can give us an indication of the strength of the tannic acid, especially if the quantity of the tannic acid had been calculated in proportion to the price. If we dye all these patterns in any aniline colour, say magenta or methyl-green, the pattern which had been prepared with the strongest tannic acid will give the deeper shade, and therefore in this case also you have a comparative method, and this method can be made even more exact by soaping these dyed patterns, and the colour which remains on the fibre will give an indication of the strength of the tannic acid employed.

Mr. **Grimshaw**: How would Mr. Sansone arrive at the value of a material used for tanning leather by the comparative process he mentions? Such a method as he alludes to would no doubt be a good criterion of the value as a dye, but is not applicable to its use for tanning, where many different constituents are absorbed by the leather or skin, and comparative "tanning" would be a very different thing from comparative "dyeing."

Mr. **Sansone**: The method I mentioned is only valuable to dyers of cotton; but for leather I should think a comparative method might also be tried.

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NOTE ON THE DESTRUCTION OF TANNIN BY BOILING SOLUTIONS OF GAMBIER.

BY BERTRAM HUNT.

Gambier, as you are doubtless aware, is an extract from the plant *Uncaria Gambir*, and is imported in large quantities from Singapore. It occurs in the market in two forms—"bale" and "cube"—of which the latter is the more valuable, being drier than the "bale," and offering less opportunity for fraudulent adulteration. It is used largely in tanning, the strong liquor made by dissolving about four pounds per gallon in boiling water being added in suitable proportions to the tan liquor in the pits. The usual method of dissolving gambier is to put it in a tank with the requisite quantity of water, and boil up with naked steam till the whole is melted. The solution has to be used while hot, as if allowed to cool it "sets," and becomes semi-solid. During the boiling the colour of the liquor becomes very dark, and there is an evident loss of tannin. It occurred to me that it would be of interest to estimate the amount of this loss, and I have done so with the following results. 400grm. of cube gambier were placed in a flask, with a litre of water. The flask was then connected to an inverted condenser, and the contents heated to boiling and boiled gently for 20 minutes. 400grm. of the same gambier were now placed in a stoppered test-mixer, with a litre of water heated to 60° C., and the test-mixer shaken till all the gambier was dissolved. The two solutions were allowed to stand over night, and the clear liquor then analysed, with the following results:—

WATER AT 60° C.

Tannin, as oxalic acid	15·960grm.	per 100cc.
Other matters	4·200grm.	"
Total Extract	21·200grm.	"

BOILED.

Tannin, as oxalic acid	15·521grm.	per 100cc.
Other matters	4·536grm.	"
Total Extract	21·560grm.	"

The experiment was repeated under the same conditions, with the exception that the boiling in the one case was continued for 40 minutes. In this experiment 0·504grm. tannin per 100cc. were destroyed. These results show that when working under conditions more favourable for the preservation of tannin than are the case in practice, there is a considerable loss of tannin. Without taking into consideration the loss incurred owing to the darkening of the colour (which, with tanners, is an important point), if the gambier liquor is made by dissolving four pounds in one gallon of water, and gambier containing 50% tannin at 26s. per cwt. be taken, it will be found on calculating that the value of the tannin destroyed comes to a fraction over £1 for every 1000 gallons of liquor made.

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NOTES ON THE TESTING OF DYEWOOD EXTRACTS, AND SIMILAR PREPARATIONS.

BY L. SIEBOLD.

Mr. Siebold stated that it had been, and was still his intention to deal with this subject in a more complete manner at an early meeting next session, The various published methods for the analysis of dyewood extracts were commented unfavourably upon, their being regarded as very unsatisfactory and affording no trustworthy indication of their value to the dyer and printer. Chemical knowledge of these preparations is still in a very imperfect state; and as long as this is the case the essayist prefers to rely for this purpose on carefully conducted dyeing experiments rather than on chemical analyses. In the majority of cases wool dyeing is much to be preferred to cotton dyeing for these tests, inasmuch as the former renders a complete exhaustion of the dye-bath possible, while the latter does not, and even where the extract under examination is intended for cotton dyeing he is still decidedly of opinion that the testing should be done by means of wool dyeing, which is in every way better calculated to show the actual strength of the preparation to be tested. Experimental cotton dyeing is in most cases less a criterion of the actual strength and money value of an extract, than of the more or less developed or oxidised condition in which the colouring matter exists in it, and gives the experimentor a better idea of the speed of dyeing than of the real extent of the dyeing power of the preparation. In many cases its indications are entirely deceptive. A number of instances in support of this view was mentioned by the essayist. He laid great stress on the necessity of conducting these dyeing trials with a degree of care and accuracy equal to that required in chemical analysis, and showed that it is impossible to distinguish with certainty between one extract and one but slightly inferior to it, unless the greatest care is given to the weighing of the extracts, the measuring of the solvents, and to the perfect equality of temperature, and other conditions during the dyeing process. The mordanting, too, should be conducted with the same degree of exactness. Mr. Siebold explained a variety of circumstances likely to lead to erroneous results, and the best conditions for ensuring success in these tests. All the details respecting these will be published in the more exhaustive paper promised by him on this subject.

DISCUSSION.

The CHAIRMAN, in proposing a vote of thanks, said: It seems to me that communications similar to those given by Mr. Hunt and Mr. Siebold are particularly valuable to the Society in showing how necessary it is—not less necessary in the workshop, the dye house, and the colour shop than in the laboratory—in all cases to adopt a system of scientific accuracy in order to bring our industries forward.

Mr. W. THOMSON, in seconding the vote of thanks, said: I understood Mr. Siebold to say that he added 3 per cent. of chromate of potash. It has always puzzled me to know how it is that if you use double the quantity of water you get the same results?

Mr. SIEBOLD: It is practically immaterial whether the quantity of water used in mordanting pieces of wool with bichromate of potash is exactly the same in each case or not. What is important is the ratio of the bichromate to the weight of the wool. If I were to mordant a piece weighing 10grms. in a litre of water containing 0·3grm. of bichromate, the result would not materially differ from that obtained by mordanting three such pieces together in the same quantity (1 litre) of water containing three times that proportion (0·9grm.) of potassium bichromate. The main point in testing a dyewood extract by wool dyeing, is the presence in the cloth of a sufficient amount of mordant to fix the entire quantity of colouring matter used in the experiment, or, in other words, to completely exhaust the dyebath. In the case of logwood extract, this end is completely attained by boiling such a piece of well-mordanted wool, in the case of logwood or fustic extract, for 1½ hours in a litre of solution containing not more than 0·6grm. of the extract to be examined.

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Notices of papers and communications for the Meetings to be sent to the Local Secretary.

May 5. 1. "Wood Naphtha," by Mr. C. A. Fawsitt; 2. "Notes on Destructive Distillation," by Professor Mills.

ADDENDUM.—Mr. COLEMAN desires to state that upon coming to complete his paper on an "Improved Air Thermometer," preliminary notice of which was communicated to the Society on the 6th of January, 1885, he finds he ought to have stated that the lengths of degrees being doubled when the absolute temperature of the air in the bulb is diminished one half, is only true when the expelled air is measured at the reduced temperature, for when it is measured at the initial temperature the degree will be quadrupled in length, as the *density* of the air at the reduced temperature will be double of what it was at the commencement.

Journal and Patent Literature.

II.—FUEL, GAS, AND LIGHT.

The Illuminating Power of Hydrocarbons. I. Ethane and Propane. Percy F. Frankland, Ph.D., B.Sc. Abstr. Proc. Chem. Soc. 1884-5 [4], 31.

IN continuing his researches on illuminating gas, the author has determined the illuminating powers of ethane and propane. The gases were prepared by the action of the zinc-copper couple on ethyl and isopropyl iodides respectively, and then subjected to purification by passing them through bromine. The illuminating power of ethane, when consumed from a "referee's burner," at the rate of 5 cubic feet per hour, was found to be 34·8 candles, and that of propane 53·3 candles. The illuminating power of ethane is thus almost exactly half that of ethylene (68·5 candles), whilst that of propane is 1·5 times as great as that of ethane. From these results it appears that in the paraffin series of hydrocarbons, excluding the first member, methane, the illuminating power is directly proportional to the number of carbon atoms in the molecule.—W. S.

Combustion in Dried Gases. By H. Brereton Baker, B.A Abstr. Proc. Chem. Soc. 1884-5 [5], 37.

Led by Dr. Dixon's experiments, the author has investigated the question whether moisture is necessary for the combustion of carbon and phosphorus in oxygen. The phosphorus used (commercial amorphous phosphorus) had been washed with water and dried at 100° in a current of carbon dioxide previously passed through two wash-bottles of sulphuric acid; it was then heated in a Sprengel vacuum, at 150-160°. The carbon (finely powdered charcoal) had been heated to bright redness in a current of dried chlorine for three hours; the tube containing it was then transferred to an air-bath and heated at 200° while a current of dried air was passed through it. Portions (0·5—1grm.) were sealed up in bent hard glass tubes along with phosphoric oxide, the tube being filled with oxygen prior to sealing; to free the glass from adhering moisture, the ends of the tubes containing the carbon or phosphorus were heated in an air-bath at 130-150°, the other ends being kept cool. After about eight days, the tube containing phosphorus and dried oxygen, and another similar tube with phosphorus in oxygen saturated with water, were supported at the same height above the flame of an Argand burner: the phosphorus in the wet gas soon took fire, but that in the dried gas slowly distilled and formed a red and yellow deposit on the cooler part of the tube. A similar pair of tubes containing carbon was placed over the large flame of a Bunsen burner: the moist carbon burnt with bright scintillating flashes, but no apparent combustion took place in the tube containing dried gas, though it was heated to bright redness for several minutes. A series of such experiments with carbon were then made, in which the drying extended over various periods, the gaseous contents of the tubes being analysed after the tubes were heated. The results obtained clearly show that the burning of carbon is much retarded by drying the oxygen to the extent which is possible with the arrangement adopted by the author. Other forms of the experiment were described, which led to similar results. The author successfully made an experiment before the Chemical Society with two tubes, the one containing dried, the other undried, oxygen and carbon.—W. S.

	Wet.	Dried 1 Week.	Wet.	Dried 2 Weeks.	Wet.	Dried 4 Weeks.	Wet.	Dried 8 Weeks.	Wet.	Dried 12 Weeks.	Wet.	Dried 16 Weeks.
CO_2	50·1	15·1	51·0	19·0	45·3	11·1	23·3	12·5	58·8	15·8	52·4	17·8
CO	22·2	20·6	31·2	11·8	32·5	27·8	60·0	27·5	23·2	21·2	25·2	16·5
O_2	—	11·3	—	46·1	—	28·2	—	39·0	—	33·3	—	45·0
N_2	27·6	22·6	17·7	20·1	22·1	29·8	16·6	21·0	17·9	26·6	22·3	20·6

The Explosion of Coal-dust. A. Gurlt. Berg-u. Hüttenmannische Zeitung, 1885, No. 3, p. 21.

The author describes experiments which show that coal-dust can give rise, like marsh gas, to dangerous explosions.—A. G. G.

Improvements in Apparatus for Purifying Coal-gas. W. T. Walker. Eng. Pat. 2279, January 28, 1884.

This specification describes a modification in the construction of Walker's scrubber. The lower portion of the scrubber is filled with thin boards set on edge, each layer crossing the next; the upper portion is filled with coke. The topmost portion of the scrubber is made of an enlarged diameter, and an annular seal cup is formed inside the enlarged part to act as a seal in which the inverted edge of a perforated dashplate rotates above the coke. The perforated dashplate being of greater diameter than the main body of the scrubber, the water is distributed over the entire area of the scrubber. Above the dashplate are the water-distributing arms, which will be rotated in the direction opposite to that of the dashplate. The outlet for the gases from the scrubber is placed above the dashplate to compel them to pass through the wet perforations in the dashplate. The lowermost portion of the scrubber is arranged as a washer to remove the tar, of which, however, no description is given.—C. C.

Improvements in Apparatus for use in the Manufacture of Gas. B. Midgley and Wm. Nunwick. Eng. Pat. 2485, January 31, 1884.

Describes an apparatus designed for the purification of coal-gas from tar and ammonia. In a cylinder placed horizontally is arranged another cylinder. Both cylinders are closed at each end by plates, which are common to both of them. The space within the inner cylinder forms a scrubber and washer, and the space between the inner and outer cylinder a condenser. Within the inner cylinder is a wrought-iron shaft, one end of which is supported in a socket, the other end passes through a stuffing box to receive the driving gear. Fixed alternately to this shaft and to the inner circumference of the inner cylinder, are circular iron plates having perforations. The perforations of the fixed plates are near their centres, the perforations of the revolving plates are around the outer edge. At each side of the revolving plates are secured circular brushes, filling up the space between the fixed plates and the revolving plates, so as to prevent any gas passing otherwise than through the brushes. Tar and liquor run from end to end of the cylinder, either continuously or through separate compartments. The inlet and outlet of the gas are in the end plates. The space between the inner and outer cylinder forms a condenser, and water is supplied to it in regulated quantities. The gas passing through the perforations in the plates, and through the wetted brushes, is freed from ammonia and other impurities.—C. C.

Method of and Means or Apparatus for Generating Gas from Hydrocarbons. A. J. Boult. Eng. Pat. 5794, April 1, 1884.

This specification describes an arrangement for vaporising hydrocarbon oils for the purpose of using the vapour as fuel in the manufacture of iron, but it is too replete with minor details to allow of abstraction. The gist of it is apparently that the hydrocarbon oil is injected by means of superheated steam into the annular space formed by two pots of different diameters, placed one inside the other. The outer pot is heated by fire. The mixture of steam and hydrocarbon vapour passes from thence into a mixing chamber, and from it to the space where combustion takes place.—C. C.

Improvements in the Construction of Gas Retorts. G. K. Harrison, Stourbridge. Eng. Pat. 5835, January 2, 1885.

THE retorts are made circumferentially in four segments, a number of which, breaking joint, are connected together to form the length of the retort. In oval or round retorts the top and bottom segments are interchangeable, as are also the side segments. The segments have rabbeted edges, and are made to correspond with one another. Of the four segments forming the mouth of the retort, the top and bottom pieces are not only rabbeted at their edges, but also have indents formed therein, while the two side pieces are provided with projections fitting into the said indents, so that when the mouthpiece is bolted on the tightening of the screws draws all close together, and prevents the too common occurrence of the retort cracking at or about the neck.—A. R. D.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, Etc.

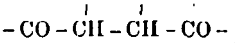
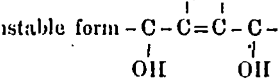
On the Presence of an Isocyanide (Carbylamine) in the "Light Stuff" from Commercial Benzene. E. Noelting. Bulletin de la Soc. Ind. de Mulhouse, October, 1884, p. 461.

THE experiments resulting in the detection of the above compound were undertaken at the request of Dr. Werner, who had performed the autopsy of a workman, who died suddenly whilst engaged in his duties at an india-rubber works at Thann, where the "light stuff" from naphtha was employed in the manufacture. When ninety per cent. and fifty per cent. benzene are rectified in aniline works, a certain quantity of a more volatile liquid than benzene distils over first, and this is technically termed "light stuff." This product has been studied at different times. Helbing found, besides a certain amount of benzene, carbon bisulphide, crotonylene, amylene, and hexylene. Witt further detected ethyl alcohol; and, finally, Vincent and Delachanal obtained, in addition to these, considerable quantities of acetonitrile and methyl cyanide. The author, who had on various occasions some of this light product in his possession, has often observed the strong odour of isocyanides. The probability of one or more of this class of bodies being present seemed to gain force from the fact that on the addition of an acid the odour in question disappeared, and was replaced by that of carbon bisulphide, alcohol, hydrocarbons, and acetonitrile. By evaporating the hydrochloric acid solution, sal-ammoniac and a small quantity of the hydrochloride of a primary amine was obtained. The proportion of isonitriles contained in the "light stuff" is very small, but the odour is very penetrating and characteristic, and its poisonous properties exceedingly energetic. From the boiling point of the "light stuff" it can only contain methyl or ethyl isocyanide, the former boiling at 59·6°, the latter at 78·1°. The "light stuff" from benzene has no practical use. The benzene is extracted as far as possible by distillation. Sometimes it is employed for dissolving caoutchouc; but for this purpose solvent naphtha, which distils at 120-150° (a mixture of a little toluene, xylene, cumene, and hydrocarbons of the fatty series, and the oils of turpentine), is generally preferred. —J. B. C.

Synthesis of Thiophen. Victor Meyer. Ber. 18, 217.

A SHORT note of the results of experiments made with a view to demonstrate the constitution of thiophen by synthetical reactions. Thiophen was formed, but in too small quantities to afford support to any proposed structural formula. By passing ethylene or petroleum spirit vapours over heated pyrites, or ethyl sulphide alone through a red-hot tube, or by heating crotonic or butyric acid with sulphide of phosphorus, thiophen was in each case obtained, whilst, according to expectation, no thiophen was obtained by the action of phosphorus sulphide on isobutyric acid.—G. H. B.

Synthesis of Thiophen and Pyrroline Derivatives. C. Paal. Ber. 18, 367.

THE author has previously shown that acetophenoneacetone by the action of dehydrating agents gives a furfurane derivative, and supposes that the diketone group  $-CO-\overset{|}{C}H-\overset{|}{C}H-CO-$ in the reaction changes into the unstable form  $-\underset{OH}{\underset{|}{C}}-\overset{|}{C}=\overset{|}{C}-\underset{OH}{\underset{|}{C}}-$ and from this the constituents of water are eliminated. From the analogy existing between furfurane, thiophen, and pyrroline, both in their method of preparation and properties, it seemed possible that by the action of H_2S a thiophene-, of ammonia, a corresponding pyrroline-derivative, might be prepared. This supposition has been confirmed.

Phenylmethylthiophen is formed by the action of P_2S_5 on acetophenoneacetone at a temperature of 120-130°. The crystalline body obtained has the formula $C_{11}H_{10}S$, and gives the characteristic blue colour with isatin and sulphuric acid. By heating acetophenoneacetone with alcoholic ammonia to 150° a corresponding pyrroline-derivative is obtained, having the formula $C_{11}H_{11}N$, and which is therefore phenylmethylpyrroline.—J. B. C.

On a Simple Method of Preparation of Thiotolen and Thioxen. K. E. Schulze. Ber. 17, 2852.

THE process described by V. Meyer for the preparation of thiophen is inconvenient owing to the large quantities of liquid which must be operated on, and to the loss by the destructive distillation of the ammonium salt of the sulphonic acid. The author attempted to obtain thiotolen and thioxen directly by the distillation of the impure sulphonic acids with aqueous vapour. In the first experiment with the xylene acid steam was passed rapidly into the acid heated to 100°, but the yield was small, and large quantities of sulphur dioxide were evolved. A much better result was obtained by mixing the acid with one fifth of its weight of boiling water, and passing a slow current of steam into the solution. The yield of oil thus rose from two to nine per cent. The product boiled, for the most part, between 135° and 138°, and the distillate contained 44·4 per cent. of thioxen. The acid contained xylene mechanically mixed with it, and this would account for twenty per cent. of the fractionated oil. The results with the toluene acid were not so satisfactory, the decomposition being greater. A better yield was again obtained by the addition of water to the impure acid. Only about four per cent. of oil was obtained, and it did not boil nearly so constantly as the crude thioxen. The product after rectification boiled between 111° and 113°, and contained 22·3 per cent. of thiotolen. A portion boiling at about 80° contained thiophen, and the author hopes to obtain this substance by the same method.—S. Y.

Thiophen from Mucic Acid. C. Paal and J. Tafel. Ber. 18, 456.

PAAL has shown (*Ber.* 18, 367) that acetophenoneacetone ($C_6H_5.CO.CH_2.CH_2.CO.CH_3$), according as it is treated with P_2O_5 or P_2S_5, yields a furfurane derivative (phenyl-methyl-furfurane), or a thiophen derivative (phenyl-methyl-thiophen). As now mucic acid also gives a furfuran derivative by splitting off water (pyromucic acid or furfurane-carboxylic acid), it seemed probable that under the influence of H_2S it would give thiophen carboxylic acid, and this proved to be the case.

Thiophen-a-carboxylic Acid.—A mixture of mucic acid and barium sulphide was heated to 200-210° in sealed tubes, the product boiled with water and filtered; the filtrate was acidified and extracted with ether. After purification the thiophenic acid formed long fine needles melting at 126-127°. Yield, 10 to 12 per cent. of the theoretical.

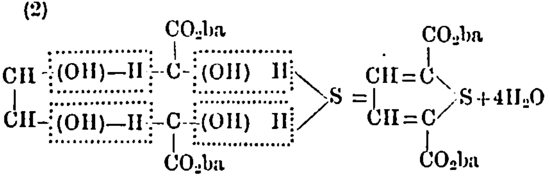
Reactions.—It gives the blue colouration with isatin and sulphuric acid. With Fe_2Cl_6 it produces a citron-yellow precipitate.

Salts.—$(C_6H_3SO_2)_2Ca,3H_2O$—easily soluble needles. $(C_6H_3SO_2)Ag$—difficultly soluble crystals.

The formation of thiophen-carboxylic acid from mucic acid probably takes place in the following stages :—

(1) Mucic acid and BaS give barium mucate and H_2S.

(2)



(3) The thiophen-dicarboxylic acid then splits off CO_2, forming thiophenemonocarboxylic acid.

Thiophen.—By distilling the thiophenic acid with lime a distillate was obtained, which, on purification, gave pure thiophen, boiling at 83-84° C. (731mm.). The yield was 40 per cent. of the theoretical. The thiophen thus obtained was in every respect identical with the coal-tar thiophen.—A. G. G.

Preparation of Thiophen. K. E. Schulze. Ber. 18, 497.

The author proposes the following simple method for the preparation of thiophen. Strong sulphuric acid, which has been shaken for three or four hours with 20 times its weight of benzene (of constant boiling point), is at once diluted with two or three times its volume of water and distilled with steam. The thiophen separated from the distillate (about three per cent. by volume of the acid used) is nearly pure, since the sulphonic acids of the benzene hydrocarbons are not decomposed in such a dilute solution; 96 per cent. of the product distilled between 84° and 85° C. The specific gravity at 15° C. was 1·1.—A. G. G.

Thiophen. V. Meyer and O. Stadeler. Ber. 17, 2778.

It is a well-known fact that commercial dinitrobenzene dissolved in alcohol gives a light magenta colouration on the addition of a drop of potash solution. The following experiments have fully explained the cause. The preparation of the nitro derivatives of thiophen made it appear probable that the corresponding amido compound analogous to aniline could be obtained. Every attempt in this direction with any of the ordinary reducing agents failed. A violent reaction occurs, the substance being completely decomposed with evolution of sulphuretted hydrogen. The nitro derivatives of thiophen, however, resemble the amines of the benzene series in their property of forming colouring matters, a fact which at first sight might appear remarkable. When, however, it is considered how much more marked are the colour-forming properties of thiophen and its homologues, compared with hydrocarbons of the benzene series, it is not surprising that the nitro derivatives should have a similar tendency. Mononitrothiophen turns red on exposure to light; boiled with aqueous alkali it dissolves, forming a deep brown solution. The colouration produced by reduction of the sulphonic acid is particularly striking. Mononitrothiophen dissolves n fuming sulphuric acid, and forms a well-defined sulphonic acid, the potassium and ammonium salts of which readily crystallise. On reduction of the nitro-sulphonic acid with ammonium sulphide a magenta-coloured solution first forms, the colour gradually vanishing on further reduction. The reaction is more striking when bibulous paper moistened with the sulphonic acid is exposed to the vapours of ammonium sulphide. The paper is coloured deep red. The reaction with dinitro-thiophen is still more intense. This substance is dissolved in alcohol, and on the addition of one drop (not more) of aqueous potash a deep red solution is produced, which in thin layers has a violet tint. An excess of alkali or acid destroys the colour; but it is restored by carefully neutralising, the colour being due to the formation of the potassium salt. By precipitation with ether a violet-red resin is left, which dissolves in alcohol without change of colour. The corresponding silver salt is a reddish-brown explosive powder. The above reaction of dinitro-thiophen with potash explains then the phenomenon observed by adding alkali to dinitro-benzene. A comparison of the colours prepared from both sources leaves little doubt as to its true nature, which is further confirmed by the fact that dinitro-benzene prepared from benzene free from thiophen gives no colouration whatever. Commercial mononitro-benzene gives the same reaction as the dinitro compound, that free from thiophene remains colourless. This distinction can therefore serve as a test for thiophen in the benzene, from which the nitro compounds have been prepared.—J. B. C.

Perchlorophenol from Perchlorobenzene. A. Weber and N. Wolff. Ber. 18, 335.

Perchlorobenzene (C_6Cl_6) heated to a high temperature with caustic soda yields perchlorophenol. Commercial glycerine is heated to 250° in a flask, caustic soda, and then perchlorobenzene, gradually added. The mixture is kept at a temperature of 250-280° for half-an-hour, and repeatedly shaken. On cooling, water is added, and the aqueous solution filtered and saturated with HCl. The precipitate which forms is recrystallised from benzene. Perchlorophenol has the formula $C_6Cl_5.OH$, melts at 187-188°, and is identical with that obtained by chlorinating phenol.—J. B. C.

The Reverse Action of Friedel and Craft's Synthetical Method for Preparing the Hydrocarbons. O. Jacobsen. Ber. 18, 338.

By the action of aluminium chloride and methyl chloride on pure mesitylene, in addition to isodurene, a quantity of durene was formed. It appeared therefore that either mesitylene gave metaxylene, then pseudocumene and durene, or that penta- and hexamethylbenzene were first produced, and then durene, by elimination of the methyl groups. In either case the formation of durene must be due to the reverse action of Friedel and Craft's synthetical method. Experiments confirmed this supposition. The hydrocarbons were heated with Al_2Cl_6, in some cases alone, and in others in a current of HCl.

Hexamethylbenzene was heated with half its weight of Al_2Cl_6 to 200°, the chief products being pentamethylbenzene, durene, and isodurene and small quantities of benzene, toluene, xylene, and trimethylbenzene.

The elimination of the methyl groups is more complete if the above experiment be conducted in a current of HCl.

Pentamethylbenzene and Durene gave similar results to those of the hexamethyl derivative, durene and isodurene being formed, also a certain quantity of hexamethylbenzene.

Pseudocumene treated in the same way gave benzene, toluene, xylene, durene, isodurene, and traces of pentamethylbenzene.

Mesitylene heated to 150-160° with Al_2Cl_6 in a current of HCl, produced traces of the lower methyl benzenes, also pseudocumene, isodurene, and durene. The chief portion, however, consisted of unaltered mesitylene.

From metaxylene the higher methylated hydrocarbons were principally obtained. The results of the experiments may be stated shortly as follows :—

By the action of dry HCl on methyl benzenes in presence of Al_2Cl_6 the methyl group may be eliminated, and the hydrocarbons reduced to their lowest homologues. In every reaction the methyl chloride formed acts upon the hydrocarbons, producing the higher homologues. These higher methylated hydrocarbons can then again undergo decomposition, so that by this reaction a process of synthesis and decomposition is going forward until a state of equilibrium is attained. Usually the elimination of the methyl group by HCl is facilitated by a high temperature, its substitution by a lower temperature.—J. B. C.

The Carbonisation of Wood. Hugo Blank. Dingl. Polyt. Journ. 255 [10], 435.

WILH. SÖLTZ, of Schemnitz, has recorded his observations during a visit to the works where wood is carbonised in Trzynietz (Austrian Silesia), which are all the more interesting because the arrangements show many differences from those existing in English works, and especially in the means adopted for working up all by-products.

The plant arrangement shown in Figs. 1 to 6 is designed for an annual consumption of 18,000 cubic meters of wood. This wood is carbonised in 22 cylinders or retorts R, set up in a line and enclosed in brickwork. These retorts are of wrought iron, and measure $2\frac{1}{2}$ meters in length, and 1 meter in diameter. Each retort has a cast-iron door, and a wrought-iron false bottom, supported by a bar with an ear or loop at its extremity, so that by attaching the chain of a locomotive windlass *a* (Fig. 5) to it, the false bottom can be drawn out, and thus the charcoal can be emptied. It falls into sheet-iron boxes placed on tram-wagons. The false bottom is *furnished with holes 2 to 3cm. wide, so that the gaseous* distillation-products can more easily be drawn off. The retorts are surrounded by brickwork, and the fire circulates around them, afterwards passing down the flue *b* (*Fig. 5*) *into the main flue c, and then to the chimney.* Fig. 6 shows how that each pair of retorts is combined with one and the same condenser K, in which the gases pass through a pipe *l* made fast in the hindmost door of the retort.

Fig 1.

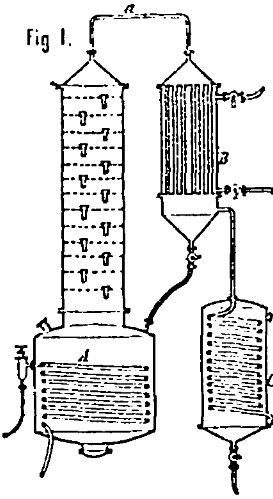


Fig 2.

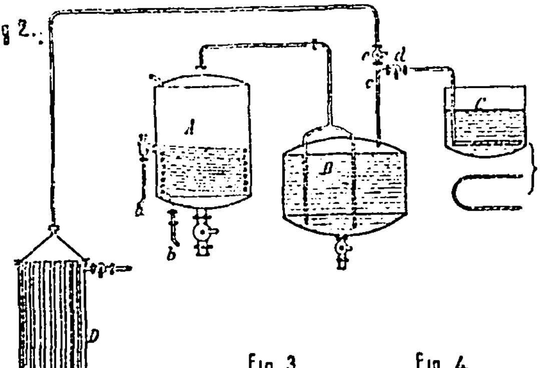


Fig 3.

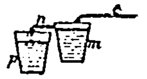
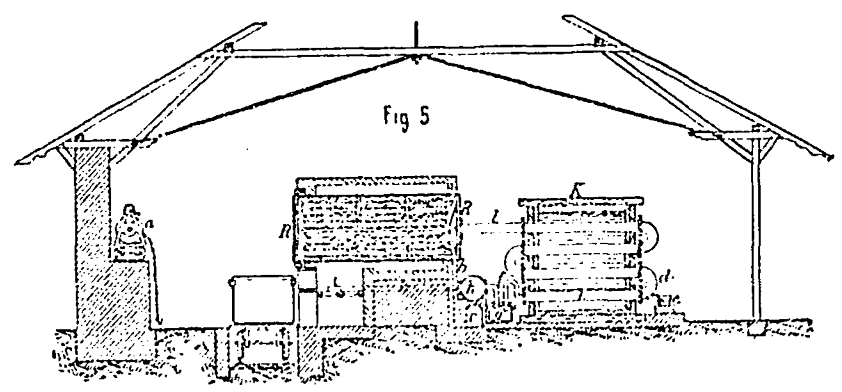


Fig 4.

Fig 5



The distillation products flow through the small side-tubes *d* into the common trough or gutter *c*, whilst the uncondensed gases pass through *f* into a common gas-holder *g*, and from this through 2 or 3 pipes into the main-pipe *h*, from which the gases pass through the small flues *i* under the fire-place, but so as eventually to enter amongst the fuel, and thus aid in heating the ovens.

The retorts only last, it is stated, from 9 to 18 months, whereas in England the wrought-iron cylinders are good for 6 years, and cast-iron ones for 15 years.

For the charring of 250kilos. of wood, 100kilos. of coal were necessary, the temperature is maintained at from 350° to 400°, and the carbonisation period covers from 8 to 12 hours.

As soon as the glowing charcoal has fallen into the sheet-iron box, the latter is closed with an iron lid, the luting made good with mortar, and the box, together with the tram-wagon, is let stand 24 hours in the cooling-chamber. The condensed products of distillation pass from the trough *c* (Fig. 3) into the vat *m*, and from this trough the overflow pipe *n* into the vat *p*, standing deeper still. In both these vats, the greater part of the tar will have already settled down; in order that this may take place more completely, the supernatant liquid is drawn off by means of a steam pump into a cistern set on a higher level, from which it is run off, just as before, into a second, and finally into a third vat (Fig. 4), which, however, contains in the middle of it a double false bottom perforated with narrow holes, and filled with good cokes.

For obtaining acetic acid, acetone, allyl- and methyl-alcohols, the watery liquid, completely freed from tar, is brought into a copper still A (Fig. 2), holding from 20 to 30 hectolitres, and heated there with a steam coil through which steam at from 3 to 4 atmospheres' pressure enters at *a* and escapes at *b*. The copper pipe from the still-head passes into an air-tight copper receiver B, where it branches off into two parts, furnished with small holes. From this vessel or boiler a copper pipe passes, branching off at right angles at *c*; the one branch passes into the open copper-boiler C, upon the bottom of which it ends in a U-shaped tube perforated with small holes; the second branch passes into the copper tubular condenser D. The vessels B and C are filled with milk of lime to fix the acetic acid. As soon as the liquid in A evaporates, the escaping acetic acid is retained by the milk of lime in B, and calcium acetate is formed; the other products of distillation on closing the cock *d* and opening the cock *c* pass into the condenser D, from whence they are run off at *f*, completely condensed; the result is, besides water, acetone, allyl- and methyl-alcohols. After evaporating off the first 10 per cent. of the contents of A, all the volatile products named are driven off completely; it is then necessary, when all the milk of lime in B is already combined with acetic acid, and still acetic acid vapours are perceptible, to absorb these vapours completely in the vessel C, effected by closing the cock c and opening *d*. The solution of calcium acetate formed in B and C is now concentrated in iron evaporating vessels over open fires, or in lead-lined wooden evaporating pans, arranged in step fashion, one above the other, and heated with steam coils, till pellicles of salt form on the surface. In order to free the salt thus separated from adhering tarry matters, it is cautiously and gently ignited. If completely pure calcium acetate is to be obtained, then the calcined crude salt is purified by solution and crystallisation. If acetic acid is to be prepared, the calcium acetate is decomposed with hydrochloric acid (100 parts of the salt require 90 to 95 parts of hydrochloric acid of 1·16 sp. gr.), and the mixture distilled in copper vessels; the condenser is best made of tin. For the preparation of chemically pure acetic acid, sodium acetate is taken.

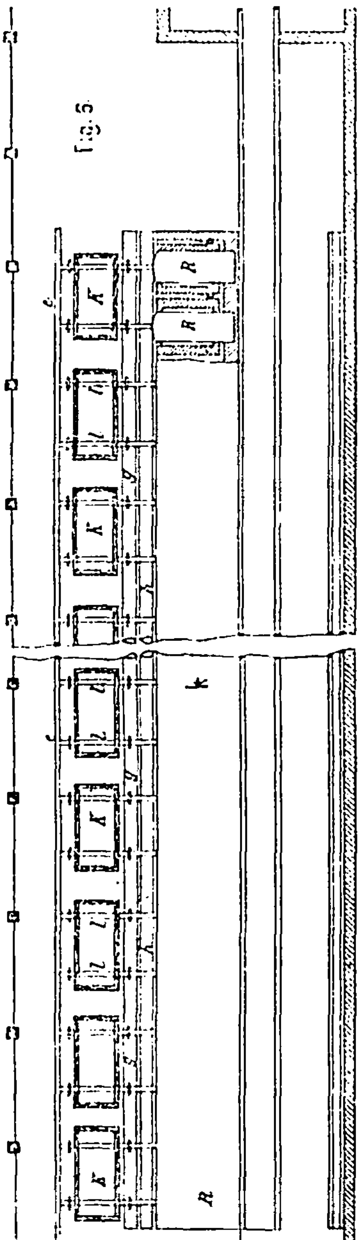


Fig. 5

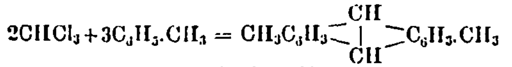
The separation of the acetone, allyl- and methyl-alcohol from the water, and from each other, is effected by means of fractional distillation, which in Trzynietz was performed in an arrangement like a Savalle's column-apparatus (Fig. 1). The liquid to be distilled is placed in the boiler or still A, heated with steam, and connected above with a column separated into several compartments *by a number of copper-sieves; the ascending* vapours pass through the sieves, and separate the water, which, condensing, falls on the sieves and forms a layer of a certain height. Whilst the vapours must pass *through this layer of water, they become constantly* drier, until they pass through the pipe *a* into the tubular condenser (dephlegmator) B. The liquid condensed here, and still containing water, is returned to A, whilst the still gaseous alcoholic constituents condense later on in the dephlegmator C, and according to the different periods of their boiling-points, first acetone, then methyl-alcohol, and, lastly, allyl-alcohol, flow out.

This Trzynietz Works is an example of the advantage of charring in retorts, and of the profit to be realised under circumstances in which the by-products can be recovered and utilised. With the ever-increasing scarcity of cheap wood-charcoal, this process in the region of great forests and rich iron-ore deposits would be of great influence in increasing profits, or making competition possible in many works. It remains yet to be ascertained by practical experiments, how far the wood charcoal obtained in retorts as described can replace that obtained in the meilers or mounds; as a contribution to such experience, experiments with Trzynietz charcoal in the Erzherzog Abrecht Works in the Bindt (Zips) have borne favourable testimony in the direction of such advantageous replacement.

—W. S.

The Action of Chloropicrin and Chloroform on Toluene in presence of Chloride of Aluminium. K. Elbs and O. Wittich. Ber. 18, 347.

The method is the same as that adopted for the preparation of triphenylmethane, the mixture of chloropicrin and toluene being, however, diluted with an equal volume of CS_2. The product was distilled with zinc dust, and an oil obtained distilling at 270-290° C., and also a portion distilling above 360°. The former was found to be ditolylmethane, the latter tritolylmethane. In all probability the tritolylmethane consists of several isomers, as it could not be crystallised. By repeating Schwarz's experiments (*Ber.* 14, 1526)—*i.e.*, substituting chloroform for chloropicrin—the authors obtained small quantities of di- and tritolylmethane and a substance *identical with that described by Schwarz as tetra*tolylethane, but which bears a strong analogy in its chemical properties to an anthracene derivative. The results of the analysis would also agree with a compound of the *formula of dimethylanthracene.* The reaction which occurs can be represented by the following equation:—



$$\mathrm{2CHCl_3 + 3C_6H_5.CH_3 = CH_3C_6H_3} \begin{matrix} \mathrm{CH} \\ | \\ \mathrm{CH} \end{matrix} \mathrm{C_6H_3.CH_3}$$

$$\mathrm{+ 5HCl + C_6H_4ClCH_3.}$$

The following proportions of the different substances employed are found to give the best yield of dimethylanthracene: 3 parts of toluene, 3 parts of CS_2, 1 part of $CHCl_3$, and 2 parts of $AlCl_3$. The dimethylanthracene obtained in this way melts at 215-216°, and is therefore not identical with either of the two already known.

—J. B. C.

Fluorene. Dr. W. R. Hodgkinson. Abstr. Proc. Chem. Soc. 1884-85 [5], 36.

In two previous notes to the Chemical Society, the author has remarked upon, and given examples of, the facility with which fluorene and its derivatives condense to a double molecule, owing to the presence of the CH_2 group. *This action takes place when fluorene is heated* to a high temperature alone or in contact with even very gentle oxidising agents. In a previous note two isomeric difluorenes were described, which were obtained from the red body produced when fluorene is passed over red-hot manganese dioxide. At that time the red body was distilled under reduced pressure, as the red colour could not be removed by crystallisation, and the distillate was then crystallised from acetic acid. It has since been found that the hydrocarbon, $C_{26}H_{18}$ (melting at 246°), termed *para-difluoryl*, suffers considerable, if not complete, decomposition even when distilled under reduced pressure. However, by distilling the crude product only so far as to separate the main bulk of unaltered fluorene, and treating the highly-coloured residue with cooled ether—which dissolves the red colouring matter and any unchanged fluorene—a very slightly coloured residue of the $C_{26}H_{18}$ hydrocarbons is obtained. The crude product forms about 10 per cent. of the original fluorene, and contains at least three isomers of the formula $C_{26}H_{18}$. The one present in greatest quantity, and the only one as yet examined, is that melting at 246°. This body forms long prisms, very slightly soluble in cold ether or chloroform, and only moderately in hot acetic acid. On slightly heating it above its melting point, it decomposes, forming another hydrocarbon of lower melting point, and a large amount of carbonaceous matter. It is not easily brominated; a cold solution in $CHCl_3$ may be treated with bromine without much action taking place, and, when heated, a tetrabromo-compound, extremely insoluble in all solvents, is formed, which melts, with decomposition, at about 302°. On boiling it with fuming nitric acid, a di-nitro-compound is formed. It is not very easily oxidised; the acetic solution requires to be boiled with a large excess of CrO_3. The product crystallises from acetic acid in very fine rhombs, melting at 255°, and sublimes unchanged. It has the composition $C_{26}H_{14}O_2$; and is probably an oxide not a quinone. Alkalis, bromine, and nitric acid scarcely affect it. The *di-haloid derivatives of fluorene, as mentioned in the* author's previous note, contrary to statements by Van Dorp and others, are readily acted upon by alkalis, halogen being removed and difluorene compounds formed; with fused or concentrated potash the action is violent, and pure products are not easily obtained. The action of alcoholic potash is more manageable, but the best result is obtained by the action of sodium ethoxide. On dissolving $C_{13}H_8Br_2$ in alcohol, and adding sodium, a green solution is formed; on dilution with water and boiling this deposits a brilliant red crystalline powder, which is exceedingly insoluble. Analysis shows it to have the composition $C_{26}H_{14}Br_2O$. This body crystallises from boiling cumene or acetic anhydride in red microscopic prisms, melting above 360°; the chloro-derivative is analogous. It appeared possible that this body might be produced by the simultaneous action of bromine and potash on fluorene; it was found, however, that the main product is monobromofluorene, identical with that already described, melting at 103-104°; this is an excellent way of making the mono-haloid derivatives of fluorene, as in the ordinary way much di-haloid derivative is always formed. Sodium ethoxide acts on monobromofluorene; *the product is of a yellow colour* and free from bromine. A mononitrofluorene is obtained by very careful addition of the calculated amount of nitric acid to a cooled solution of fluorene in acetic acid; it forms small prisms, very soluble in hot alcohol, and melts at 151°. The amido-compound from it is rather unstable. On heating nitrofluorene above its melting point it decomposes, one product being a $C_{26}H_{16}$ hydrocarbon that is not identical with any of those directly obtained from fluorene.—W. S.

Improvements in and connected with the Treatment of Gas-liquor for use in the Purification of Coal-gas. F. C. Hills, London. Eng. Pat. 5874, April 3, 1884.

In a previous specification (Eng. Pat. 934, March 14, 1874) the inventor proposed to heat the gas-liquor to be purified in a still, and pass the gases driven off into a scrubber, whilst in the present communication the gas-liquor is heated as it descends in the scrubber, the heat being applied at the lower part of the scrubber. By this means the temperature of the descending stream of gas-liquor is gradually raised, and most of the sulphuretted hydrogen and carbonic anhydride, and some ammonia, are expelled, the latter being absorbed by the cool gas-liquor in the upper part of the scrubber, whilst the sulphuretted hydrogen and carbonic anhydride pass from the scrubbber *at the upper part as described in the* previous patent.—D. B.

Improvements in the Distillation of Coal in the Manufacture of Coal-gas, for the purpose of Facilitating the Subsequent Purification of the said Gas. R. Irvine, of Royston, Granton, near Edinburgh, Scotland. Eng. Pat. 5932, April 4, 1884.

The inventor proposes to distil the coal in the presence of ammonia or its carbonate, by passing their vapour either alone or with steam into the retorts in which the coal is being carbonised. The sulphur combines with the ammonia, forming compounds of ammonia and sulphur, which may be readily arrested in the subsequent purification of the gas without the necessity for using lime or oxide of iron.—D. B.

On the Dry Distillation of Wood. M. Senff. Ber. 18, 60-64.

The author, who has had a long practical experience in the dry distillation of wood, made an extensive series of determinations concerning this special branch of chemical industry. Although the experiments were carried out in the laboratory, all conditions of the working on the large scale were carefully observed, so that the results may serve as a guide for practical work. The distillation was performed in a cylindrical retort of cast-iron, 60cm. long by 20cm. diameter, set horizontally in a small furnace. It could be hermetically closed by means of a lid and bolts. The cooling worm was very long and kept well supplied with cold water in order to effect a complete condensation, even when the distillation was carried out at the quickest rate. Air-dry wood was employed in all experiments, and great care was taken in collecting the material to be operated upon. The wood was charred without removing its bark, just as it is done on the large scale. The pieces were 20cm. long by 2-3cm. thick. If the operation of distilling was to be carried on slowly, the retort was not heated, but after charging and closing, and a uniform small fire was kept up for six hours. In a quick operation the empty retort was heated to bright redness, quickly charged with the material, closed, and a strong heat applied for three hours. The retort held from 4-6kg. wood according to quality. After finishing the distillation, the retort was kept closed till it was completely cold, and the residual charcoal was weighed immediately after opening. Its absorption of moisture was also ascertained after an exposure of several weeks to the atmosphere of a room. The term "total distillate" in the table below, means crude wood-vinegar and tar. Both were separated by means of a separating funnel. The uncondensed gas was estimated by difference—*i.e.*, wood minus (total distillate plus charcoal) equals uncondensed gas. A determination of the quantity of methyl alcohol in the distillate is difficult and untrustworthy in working on a small scale and was therefore omitted. Besides it is known from practical experience that the yield of methyl alcohol is in direct proportion with the amount of wood-vinegar. The following table shows the results, in which *a* and *b* mean slow and quick distillation respectively :—

100 KG. AIR-DRIED WOOD YIELDED—

No.	Specimen of Wood.		Total Distillate. Kg.	Tar. Kg.	Wood Vinegar.		Anhydrous Free Acid. Kg.	Charcoal.		Uncondensed Gas. Kg.
					Kg.	% Acid.		Kg.	Absorption of Water. %	
1.	Carpinus Betulus L....................... Trunk ; good state..........................	*a* *b*	52·40 48·52	4·75 5·55	47·65 42·97	13·50 12·18	6·43 5·23	25·37 20·17	6·09 10·03	22·23 31·01
2.	Rhamnus frangula L...................... Young trunks, without bark ; good state	*a* *b*	52·79 45·38	7·58 5·15	45·21 40·23	13·88 11·16	6·05 4·49	26·50 22·53	5·09 6·85	20·71 32·09
3.	Alnus glutinosa L. .... Trunk without bark ; good state	*a* *b*	50·53 47·76	6·39 7·06	44·14 40·70	13·08 10·14	5·77 4·13	31·56 21·11	6·29 9·52	17·91 31·13
4.	Betula alba L........................... Trunk good state..........................	*a* *b*	51·05 42·98	5·46 3·24	45·59 39·74	12·36 11·16	5·63 4·43	29·24 21·46	4·29 7·37	19·71 35·56
5.	Sorbus aucuparia L....................... Trunk; good state..........................	*a* *b*	51·54 46·10	7·43 6·11	44·11 39·99	12·60 10·11	5·56 4·16	27·84 20·20	4·62 8·72	20·62 33·10
6.	Fugus silvatica L......................... Trunk ; good state..........................	*a* *b*	51·65 44·35	5·85 4·90	45·80 39·45	11·37 9·78	5·21 3·86	26·69 21·90	4·61 8·45	21·66 33·75
7.	Fugus silvatica L......................... Branches ; good state	*a* *b*	49·89 43·11	4·81 2·90	45·08 40·21	11·40 10·89	5·14 4·38	26·19 21·30	5·95 8·99	23·92 35·56
8.	Populus tremula L. .... Trunk ; good state..........	*a* *b*	47·41 46·36	6·90 6·91	40·51 39·45	12·57 11·01	5·10 4·36	25·17 21·33	— —	27·09 32·31
9.	Fugus silvatica L......................... Branches ; rotten state	*a* *b*	51·31 47·32	3·56 5·99	47·75 41·33	10·08 8·88	4·81 3·67	23·23 20·98	7·56 —	25·46 31·70
10.	Quercus Robur L........................... Trunk ; good state..........................	*a* *b*	48·15 45·21	3·70 3·20	44·45 42·01	9·18 8·19	4·08 3·44	31·68 27·73	4·67 6·36	17·17 27·03
11.	Pinus abies L............................. Trunk ; good state	*a** *b*	45·37 51·75	4·42 9·77	40·95 41·98	6·66 5·70	2·73 2·39	30·27 21·18	4·85 6·98	21·36 21·07
12.	Pinus Larix L............................... Trunk; good state	*a* *b*	51·61 43·77	9·30 5·58	42·31 38·19	6·36 5·40	2·69 2·06	26·71 24·06	8·08 8·72	21·65 32·17
13.	Pinus abies L. .... Trunk ; rotten state........................	*a** *b*	46·92 46·35	5·93 6·20	40·99 40·15	5·61 4·44	2·30 1·78	31·30 24·21	4·82 9·63	18·78 29·44
14.	Pinus abies L.............................. Branches; good state	*a* *b*	46·34 43·85	8·13 5·44	38·21 38·41	5·82 4·20	2·22 1·61	25·55 23·35	9·33 9·93	28·11 32·80
15.	Pinus abies L.............................. Bark..	*a* *b*	40·53 37·80	6·99 5·36	33·54 32·44	3·34 2·64	1·12 0·86	20·24 31·59	— —	29·23 30·61

* Not completely charred.

Practical conclusions from the experiments : 1. The yield by weight of wood, vinegar, tar, charcoal and uncondensed gas, do not greatly vary with different kinds of woods. 2. The percentage of real acid in the wood-vinegar—*i.e.*, the yield of anhydrous acetic acid—differs very much. In this respect trees, bearing foliage, are better than pines ; wood, from the trunk, yields more acid than wood from branches ; wood in good state is preferable to such in rotten state. 3. A quick distillation yields an increased quantity of uncondensed gas, but at the cost of the amount of total distillate and charcoal. 4. A quick distillation yields a distillate poorer in acid ; and 5. The resulting charcoal is much more hygroscopic than that produced by a slow process of distilling. —S. H.

Improvements in the Distillation of Shale Coal or the like for obtaining Solid Paraffin therefrom. Robert Irvine, of Royston, Granton, near Edinburgh, Scotland. Eng. Pat. 5933, April 4, 1884.

The object of this invention is to prevent the decomposition of the paraffin by sulphur or its compounds during the process of distillation. For this purpose the shale or coal is distilled with steam, in the presence of ammonia or ammonium carbonate, the ammonia being recovered in the usual manner, and used again for a further operation. By this treatment the yield of paraffin is said to be increased.—D. B.

Improvements in the Distillation of Mineral Oils and in the Apparatus employed therefor. W. Young and G. T. Beilby, Scotland. Eng. Pat. 6094, April 8, 1884.

The object of this invention is the reduction of the cost of labour and fuel in the process of refining, and the more efficient fractionating of the various grades of oils, of which the crude oils are composed. The guiding principles on which the process and arrangements are founded are :—(1) continuous distillation, (2) the utilisation of the heat from the fuel employed to effect the distillation in such a manner that the high temperature, where the combustion is effective, is made to distil the oils having a high boiling point, and that as the products of combustion lose heat they are made successively to distil the more volatile oils, so that by the time they reach the chimney the heat has been fully utilised, (3) the separation of the oil vapours arising from the oils of different densities as they flow from the colder to the hotter end of the still, and (4) the conjoined heating and partial distillation of the oils on their way to the still, and the condensation of the oil vapours coming from the still in such a manner that the cold oil flowing to the still will first act as the condensing agent for the more volatile vapours from the still, and that as the oils become gradually heated by so acting as the condensing medium of the more volatile vapours, it will be made to act successively as the condensing medium of the heavier vapours, and by being thus heated and applied, will act as a means of further fractionating the oils, and at the same time conserve the heat from the condensation of the oil vapours.—D. B.

Improvements in the Distillation of Mineral Oils, their Residues and Tars, and in the Apparatus employed therefor. W. Young and G. T. Beilby, Scotland. Eng. Pat. 8409, April 8, 1884.

The apparatus for carrying out this invention consists of an iron vessel, containing a series of iron trays placed over each other. The oils are made to flow down from tray to tray of the arrangement, whilst a current of super-heated steam which is forced upwards effects the distillation of the descending oils. The coke remaining on the trays is either removed by mechanical scrapers or by hand through openings. Instead of trays the apparatus may be filled with broken coke, fire brick, hollow iron balls or similar substances presenting a large surface and having considerable spaces between.—D. B.

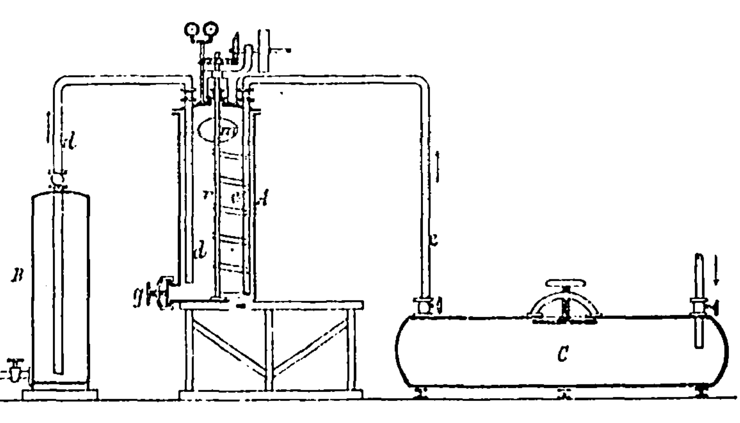
Improvements in the Bleaching or Purifying of Dark Coloured Mineral and other Distillable Oils. W. P. Thompson. Eng. Pat. 6786, April 25, 1884.

This patent is a reissue of part of the invention protected by provisional application (Eng. Pat. 5969, December 31, 1883), the remaining part of the provisional specification being covered by patent No. 5208. It consists essentially in distilling the oil through a layer of thoroughly desiccated hot porous material, preferably animal charcoal with or without superheated steam, and with or without atmospheric pressure. The vapour then passes to the condensing apparatus, which consists of a single worm in a cooling liquor, or it can be composed of a rather hot worm, then a collecting receptacle, then another worm kept a little cooler than the last, then another collecting receptacle and so on. Thus the oils of higher boiling point are still further fractionated from the lower, being deposited in the first receptacle. From the last of the receptacles (and in most cases one worm and one receptacle will suffice) a pipe is led to an air pump so as to keep up a vacuum, and enable the oil to be distilled at a lower temperature, and also to come over of a lighter colour.—D. B.

IV.—COLOURING MATTERS AND DYES.

Apparatus for the Manufacture of Colours containing Sulphur. Dingl. Polyt. Journ. 254 [8], 345.

M. Majert, of Heidelberg, has found (Ger. Pat. 27,277, October 25, 1883) that in the preparation of colouring matters from aromatic paradiamines by Lauth's process—treatment with sulphuretted hydrogen and ferric salts in a cold dilute, acid solution—bye-products of a red colour, and containing a larger amount of sulphur, are formed, and that the greater part of the sulphuretted hydrogen is oxidised to water and sulphur without taking part in the reaction. In order to obtain a good yield of colouring matter it is necessary to work with very dilute solutions, so that a sufficiently large excess of sulphuretted hydrogen is retained in the liquor. The best yield of colouring matter is obtained by employing for 1 part phenyleneparadiamine 200 parts of the solvent saturated with sulphuretted hydrogen at 15°, this being three times the amount of sulphuretted hydrogen required by theory. The yield of colouring matter increases with the amount of acid contained in the solution, but it is out of proportion with the cost involved by the employment of such large quantities of liquor which have to be dealt with when a certain amount of acid is exceeded. To obviate these drawbacks, and allow of the use of a more concentrated liquor, a lead-lined boiler A, holding 2 cubic metres and standing a pressure of 25 atmospheres, is employed. It is furnished with a copper agitator *r*, vacuum and pressure gauges, manhole *m*, and a safety valve, opening at 20 atmospheres' pressure. Fifty kilos. paraphenylenediamine dissolved in 1200kilos. sulphuric acid at 25° B. are introduced into the boiler A; the safety valve is then lifted and 40kilos. of compressed sulphuretted hydrogen are allowed to pass through the pipe *d* into A. The valve is closed again as soon as all the air in the boiler A has been displaced. The temperature of the liquor in A falls considerably, whereas the pressure rises to five atmospheres. The agitator is then set in motion, and a 20 per cent. solution of ferric sulphate is by means of compressed air transferred from the vessel C through the pipe *c* into A, until a vacuum of 200 millimetres is reached. It is advisable to cool the boiler A while the reaction is proceeding. When it is finished, a green solution, containing ferrous sulphate and sulphur in solid form, is obtained, which is discharged through *g* into a tank containing about 2 cubic metres of water. The solution, which now assumes a violet colour, is filtered, and the colouring matter precipitated by means of zinc chloride and common salt. It dyes violet shades. Paramidoethylaniline, under the same conditions, forms a blue; para-amidodimethylaniline, para-amidodiethylaniline, and para-amidomethylethylaniline, greenish-blue colouring matters.—F. M.



Action of Alcohol on Diazo-Compounds. Ira Remsen. Ber. 18, 65.

A. W. Hofmann, Hallen, and of Wroblewsky (Ber. 17, 1917, 1887, and 2703), and other investigators, have found that a diazo-compound, when decomposed by boiling with alcohol, does not *always* yield the corresponding hydro-carbon as previously supposed, but that *sometimes* the ethyl-ether of the corresponding phenol is produced. The author points out that Brown (Amer. Chem. Journ. 4, 374) has also made the same observation, obtaining ethoxymetatoluic acid by boiling the diazo-compound of amidometatoluic acid with alcohol. Palmer has just found that by the decomposition of the diazo derivative of amido-orthotoluene sulphonic acid by alcohol, both orthotoluene sulphonic and ethoxyorthotoluene sulphonic acids are formed, their relative proportions depending apparently on the pressure under which the decomposition was carried out. The author is now investigating the influence of pressure on this decomposition of diazo-compounds by alcohols.—S. H.

Conversion of Phenols into Amines. K. Buch. Ber. 17, 2634.

Benzene-Phenol and *p*-toluidine, or *p*-cresol and aniline, on heating with zinc chloride from 260° to 300°, yield phenyl-*p*-tolylamine

$$C_6H_5.NH_2 + C_7H_7.OH = (C_6H_5.C_7H_7)NH + H_2O.$$
$$C_6H_5.OH + C_7H_7.NH_2 = (C_6H_5.C_7H_7)NH + H_2O.$$

Also by heating benzene-phenol and *p*-toluidine with calcium chloride to 300°, phenyl-*p*-tolylamine is formed, although in very small quantity. A better yield of the mixed secondary amine was obtained by the action of antimony trichloride on a mixture of aniline and *p*-cresol. Along with this diphenylamine was formed, and metallic antimony obtained. The mixed secondary amine evidently escapes the double decomposition of the aniline with *p*-cresol, whilst the diphenylamine escapes that of the aniline with its hydrochloride. By heating *p*-toluidine and benzene-phenol with phosphorus pentoxide, no phenyl-tolylamine was obtained, but only ditolylamine. By the action of ammoniacal zinc chloride, or continued heating to 300° and above that temperature, *p*-cresol was converted into *p*-toluidine, concurrently some di-*p*-tolyloxide was obtained. The oxide crystallised in silky plates or needles, was somewhat sparingly soluble in alcohol, melted at 165°, and is a volatile substance. Di-*p*-tolyloxide was also formed by heating *p*-cresol with zinc chloride, or with the zinc chloride-aniline compound. Aniline and phenol yield, on heating with excess of calcium chloride at 300°, diphenylamine, but only in small quantity. Diphenylamine is formed along with metallic antimony and resinous matters, by the action of *antimony* trichloride or aniline alone, but in much larger quantity, when for aniline, a mixture of aniline and phenol with its hydrochloride is substituted. In this case, the reaction of the aniline associates itself with that with phenol.—W. S.

Orthonitraniline-sulphonic Acid and Orthonitraniline. R. Nietzki and T. Benckiser. Ber. 18, 294.

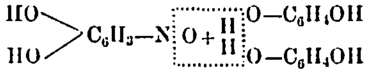
The authors prepare this acid by nitrating the acetyl derivative of sulphanilic acid. For this purpose the sodium salt of acetyl-sulphanilic acid is dissolved in conc. H_2SO_4, and the calculated amount of HNO_3, previously mixed with H_2SO_4 added. The mixture is run on to ice, saturated with lime, and the lime salt at once decomposed with sulphuric acid, by which method the acetyl group is at the same time eliminated. On heating the potassium salt to 170-180° with conc. HCl in a closed tube the sulpho group is replaced by hydrogen, and orthonitraniline (m.p. 71·5°) obtained. Starting from acetanilide and treating this with fuming H_2SO_4 the authors have prepared sulphanilic acid. On the addition of nitric acid as before, nitraniline-sulphonic acid and nitraniline may be obtained in nearly theoretical quantities. A further study of the acetyl derivatives of naphthylamine sulphonic acid is intended.—J. B. C.

Azonaphthalene. R. Nietzki and O. Goll. Ber. 18, 297.

In order to determine whether the substance, called by Laurent "naphtase," is actually an azonaphthalene as supposed, the authors have succeeded in preparing from amido-azonaphthalene a compound having the formula $C_{20}H_{14}N_2$, differing in its properties from naphtase of Laurent, but possessing colouring powers analogous to azobenzene. The action of ethylnitrite on amido-azonaphthalene, according to Griess's method, does not eliminate the amido group; but by treating amido-azonaphthalene sulphate with sulphuric acid and sodium nitrite at a temperature of 10-15°, diazo-azonaphthalene sulphate crystallises out on standing. This yields α-azonaphthalene when boiled with alcohol, nitrogen and aldehyde being at the same time evolved. By adding water gradually to the alcoholic solution, α-azonaphthalene separates out as a brown flocculent precipitate, which may be purified by recrystallisation from alcohol. Azonaphthalene obtained thus melts at 190°, and dissolves in the ordinary solvents with characteristic colours.—J. B. C.

Colouring Matters from Phenols. H. Brunner and W. Robert. Ber. 18, 373.

In the preparation of nitrosoresorcin and nitrosoorcin by the action of amylnitrite on the sodium salts of the respective phenols, and precipitation with sulphuric acid, the authors observed that from the washings a *new* substance separated out on standing. This was dissolved in ammonia, and by the addition of hydrochloric acid a reddish-brown precipitate formed, part of which dissolved in ether. The portion soluble in ether dissolves in alkalis with a violet colour and brown fluorescence, and has the formula $C_{18}H_{13}NO_6$. According to the authors these compounds are produced by the union of one molecule of the nitrosophenol with two molecules of the phenol, the oxygen of the nitroso group uniting with two hydrogens of the hydroxyl groups to form water as follows :—

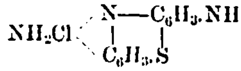


$$= (OH)_2C_6H_3N(OC_6H_4OH)_2 + H_2O$$

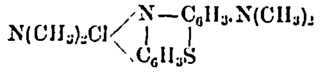
The portion insoluble in ether is likewise a colouring matter dissolving in alkalis, and concentrated H_2SO_4 with a violet or blue colour. This compound has not been fully investigated, and will form the subject of further research.—J. B. C.

Methylene Blue and Related Colouring Matters. August Bernthsen. Ber. 17, 2854.

The author has proposed the following constitutional formulæ for Lauth's violet and methylene blue (*Berl. Ber.* 17, 611 ; 16, 1025 and 2896) :—

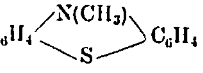


Lauth's violet.

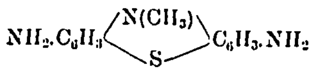


Methylene blue.

In support of this view the author draws attention to the analogous formation of these colouring matters, and those of the rosaniline group from the leuco-bases, and to their monovalent character. If the above formulæ are correct, it might be inferred that by the introduction of two amido groups into methyl-thio-diphenylamine—



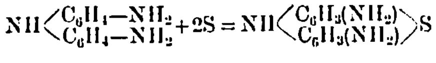
a diamido-compound—



would be formed, and not a colouring matter analogous to Lauth's violet, and this is in fact the case. By the action of fuming nitric acid the methyl-thio-diphenylamine is converted into a dinitro-methyl-diphenylamine sulphoxide—

$$CH_3.N:(C_6H_3.NO_2)_2:SO$$

which differs from the homologous dinitro-diphenylamine sulphoxide, $NH(C_{12}H_6)(NO_2)_2SO$, in being insoluble in dilute alkalis. The nitro-compound is reduced by stannous chloride and hydrochloric acid, and the resulting amido-compound is insoluble in hydrochloric acid, but dissolves readily in water. The hydrochloride crystallises in colourless prisms. Ammonia liberates the base from the aqueous solution of its salt. It is readily oxidised. Ferric chloride colours the solution of the hydrochloride blue-green, and by addition of zinc chloride and common salt an extremely unstable crystalline compound is precipitated. This compound differs greatly from Lauth's violet, which is very stable. Lauth's violet may be prepared not only by conversion of thio-diphenylamine into the amido compound, but also by introduction of sulphur into para-amido-diphenylamine, by simply heating the two substances together, thus:—

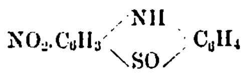


$$NH\left\langle\begin{matrix}C_6H_4-NH_2\\C_6H_4-NH_2\end{matrix}\right. + 2S = NH\left\langle\begin{matrix}C_6H_3(NH_2)\\C_6H_3(NH_2)\end{matrix}\right\rangle S$$

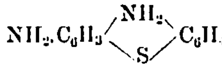
It has also been prepared qualitatively by heating para-nitroaniline with sulphur.—S. Y.

Methylene Blue and Related Colouring Matters. August Bernthsen. Berl. Berl. 17, 2857.

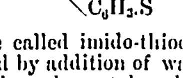
THE author has shown (*Berl. Ber.* 17, 611) that by the action of fuming nitric acid on thio-diphenylamine α- and β-dinitro-diphenylamine sulphoxides are formed, and that these substances, by reduction and subsequent oxidation, yield Lauth's violet and an isomeric colouring matter. The author has prepared a new colouring matter by introducing only one nitro group into thio-diphenylamine. When a weaker nitric acid is employed, besides the two dinitro bodies, a mononitro compound



is formed. The leuco compounds were obtained by the action of stannous chloride and hydrochloric acid, and after the removal of the tin, by means of zinc, a compound separated out, which gave a deep violet-red colour with ferric chloride, while the isomeric diamido-compounds remained in solution. The base was set free by an alkali, and was found to have the composition



It forms glittering white needles, which are soluble in alcohol and ether, and though readily oxidised, it is more stable than Lauth's white (diamido-thiodiphenylamine). The hydrochloride, which crystallises in small white or grey scales, was analysed. On addition of ferric chloride to its acid solution, a violet-red colouring matter is formed, which must have the constitution



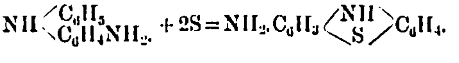
and which may be called imido-thiodiphenylimide. It may be precipitated by addition of water to its alcoholic solution in rust-coloured crystals, which are readily decomposed. It is reduced by ammonium sulphide, forming a leuco-base. The hydrochloride is best obtained by passing hydrochloric acid gas into an ethereal solution of the base. It forms a well-crystallised double salt with zinc-chloride, the composition of which is

$$2C_{12}H_8N_2S,HCl + ZnCl_2.$$

The salts of imido-thiodiphenylimide colour silk a violet-red with a brownish tint. They have little value as colouring matters. The same substance may be prepared by the introduction of sulphur into the para-amidodiphenylamine obtained from Orange IV.,

$$C_6H_4(SO_3Na) - N = N - C_6H_4 - NH - C_6H_5,$$

by the action of ammonium sulphide. When heated with sulphur, the following reaction takes place—



$$NH\left\langle\begin{matrix}C_6H_5\\C_6H_4NH_2.\end{matrix}\right. + 2S = NH_2.C_6H_3\left\langle\begin{matrix}NH\\S\end{matrix}\right\rangle C_6H_4.$$

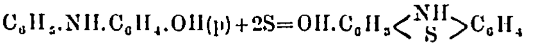
The identity of the two bodies and their leuco compounds was proved by a comparison of their properties. The above-mentioned method of formation of amido-thiodiphenylamine shows that the amido and imido group stand in the para position with regard to each other.—S. Y.

Methylene Blue and Related Colouring Matters. August Bernthsen. Ber. 17, 2860.

COLOURING matters are produced by the introduction of amido groups into thiodiphenylamine, and subsequent removal of two hydrogen atoms. The author and A. Simon have succeeded in preparing similar colouring matters by introducing hydroxyl groups. It was not considered probable that hydroxyl groups could be introduced into thiodiphenylamine, and therefore hydroxydiphenylamine was heated with sulphur, so as to form the thio compound. Paraoxydiphenylamine

$$C_6H_5.NH.C_6H_4.OH(p)$$

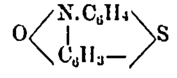
was prepared by Calm's method (*Berl. Ber.* 16, 2786; 17, 2431) from hydro-quinone, aniline, and zinc chloride, and the crystals were melted with sulphur, when the following reaction took place:



$$C_6H_5.NH.C_6H_4.OH(p) + 2S = OH.C_6H_3<\begin{matrix}NH\\S\end{matrix}>C_6H_4$$

$$+H_2S.$$

The fused mass containing hydroxythiodiphenylamine was powdered, extracted with hydrochloric acid, and the residue dissolved in alcohol and a little hydrochloric acid, and treated with ferric chloride, when a brown precipitate of oxythiodiphenylimide was produced. The substance was purified and analysed. It dissolves easily in aniline, and crystallises from its solution in this substance in dark microscopic needles. Its method of formation, together with the fact that it possesses neither acid nor basic properties, shows that its constitution is

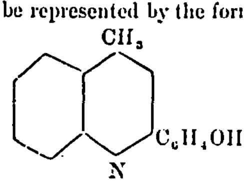


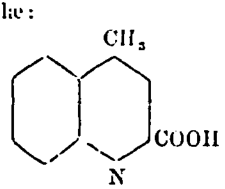
It is analogous to the amido-compounds, and is a colouring matter.

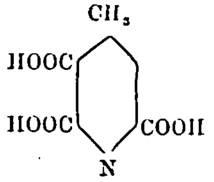
Reducing agents convert oxythiodiphenylimide into the hydroxy compound, which has the properties of a phenol, and is taken up by alkalis from its ethereal solution. It is oxidised on exposure to air, and is reconverted into oxythiodiphenylimide. The alkaline solution resembles that of indigo, in its liability to oxidation, and in its colouring properties, but the scum which forms on the surface has a red-brown colour. The composition of the leuco compound $C_{12}H_9NSO$ was confirmed by analysis.—S. Y.

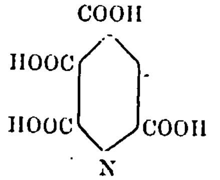
Note on Flavaniline. O. Fischer and E. Täuber. Ber. 17, 2925.

EXPERIMENTS on the oxidation of flavenol, obtained from flavaniline, show that the latter substance belongs to a new class of quinoline colouring matters. By oxidation of flavenol a lepidine carboxylic acid is formed, and this on further oxidation yields a picoline tricarboxylic acid. The authors now find that the final oxidation product of flavenol is a pyridine tetracarboxylic acid, identical with that described by R. Michael (*Ann. Chem. Pharm.* 225, 142). Picolinetricarboxylic acid was prepared by treating nine molecules of potassium permanganate with one of flavenol. The oxidation of 30grm. of flavenol was completed in about three days. Oxalic acid was found to be present in considerable quantity. The acid melts at 230-232°, decomposes rapidly at 236°, and begins to darken at 190°. A dilute aqueous solution of the acid gives a brown-red colouration with ferrous sulphate, a very dilute solution a gold-yellow colour. Calcium chloride gives a white precipitate, insoluble in hot water, with a concentrated solution of the ammonium salt. With a very dilute solution, however, no precipitate is formed. The acid thus resembles malonic acid. Barium chloride gives a similar precipitate; copper acetate and sulphate produce no precipitates. This picoline tricarboxylic acid is identical with that prepared by Michael from collidinemonocarboxylic acid, for on oxidation they both yield the same pyridine tetracarboxylic acid. This acid was prepared directly from flavenol, by treating one molecule dissolved in dilute caustic soda with eleven molecules of permanganate. The reaction was completed by heating the mixture on the water-bath for a day. The solution was filtered, neutralised with dilute nitric acid, treated with lead nitrate and the lead salt decomposed by sulphuretted hydrogen. Oxalic acid was removed by means of calcium chloride. The pure acid was prepared from the little soluble copper salt. After removal of water at 115° the composition of the acid was found to be $C_9H_5NO_8$. The acid dried at 100°, melts at 187°, the anhydrous acid at 227°, with decomposition. Michael gives the melting-point 188°. The aqueous solution of the acid gives a slight precipitate with calcium chloride, a heavy white precipitate with barium chloride, an intense cherry-red colour with ferrous sulphate, a dirty white precipitate with ferric chloride, and a green precipitate with copper salts, insoluble in hot acetic acid. The silver and barium salts were analysed. The latter contains one molecule of water, which it retains at 170°. These reactions show that the picoline tricarboxylic acid and the pyridine tetracarboxylic acid are identical with those prepared by Michael; and the constitution of the substances described must be represented by the formulæ:


Flavenol.


Lepidine carboxylic acid.


Picoline tricarboxylic acid.


Pyridine tetracarboxylic acid.

—S. Y.

On β-Amido-alizarin. Heinrich Brunner and Ernest Chuard. Ber. 18, 445.

If in the method of preparing alizarin blue another polyatomic alcohol (erythrite, mannite, glucose or saccharose), be substituted for the glycerine, an analogue of alizarin blue is not produced, but instead the nitro-alizarin is reduced to β-amido-alizarin. For instance, if a mixture of nitro-alizarin (1 part) and erythrite (5 parts) is heated to 100° C. with 10 parts of H_2SO_4, and the melt poured into water, a precipitate is produced, which, after recrystallising from alcohol, forms the glistening red prisms of β-amido-alizarin. It dissolved in caustic alkalies with a blue colour; and dyed red with alumina mordants, and greyish violet with iron mordants. The yield is small. β-amido-alizarin (mixed possibly with some alizarin blue) is also formed by the action of H_2SO_4 on a mixture of nitro-alizarin and allyl alcohol.

—A. G. G.

On Compounds of Nitrosonaphthols and Nitrosonaphtholsulphonic Acids, with Iron and Cobalt. O. Hoffmann. Ber. 18, 46.

Several nitrosonaphtholsulphonic acids—*e.g.*, that obtained from Schaeffer's β-naphtholmonosulphonic acid, etc.—yield, with iron and cobalt salts, green or brown-red dye-stuffs, which are the subject of a patent taken out by Messrs. Gans and Co., Frankfort-on-the-Maine. The metals in these compounds cannot be precipitated by alkalis or their carbonates. A determination of the iron in the green dye from nitroso-α-naphtholsulphonic acid, showed it to contain 7·9 per cent. Fe. β-nitroso-α-naphthol and α-nitroso-β-naphthol show a similar behaviour with iron and cobalt salts; but their precipitates are not applicable for dyeing. Only orthonitrosonaphthols give precipitates with iron and cobalt; and it therefore seems probable that the ortho position of the nitroso and hydroxyl group is necessary for the reaction.—S. H.

On Pseudocumidine. S. Haller. Ber. 18, 89-94.

A. W. Hofmann, and recently Liebermann and Kostanecki, have shown that commercial crystallised cumidine, prepared on the large scale from dimethylxylidine, is identical with Schaper's pseudocumidine, derived from pseudocumene. The author has again investigated this question from other points of view, and has arrived at the same conclusions as the former investigators. In order to obtain the hydrocarbon, diazocumidine sulphate was treated with alcohol; but the reaction, as Hofmann and Wroblewski have recently shown, does not proceed in the usual manner, but yields the ether of pseudocumol. However, by treating pseudcumylhydrazine

$$NH_2.NH.C_6H_2(CH_3)_3$$

with copper sulphate—a new reaction, suggested by Baeyer—the hydrocarbon can be easily prepared. The hydrazine was produced by converting pseudocumidine into the diazo compound

$$C_6H_2(CH_3)_3.N:N.SO_3Na_2+2\tfrac{1}{2}H_2O$$

reducing it with zinc-dust to

$$C_6H_2(CH_3)_3.NH.NH.SO_3Na+1\tfrac{1}{2}H_2O$$

and treating the latter with dilute hydrochloric acid. For the purpose of converting pseudocumylhydrazine into the hydrocarbon pseudocumene, the former is boiled with water, while a copper sulphate solution is gradually added until the liquor has a permanent greenish-blue colour. The reaction probably proceeds thus:—

$$NH_2:N.C_6H_2(CH_3)_3\ .$$
$$2CuSO_4+H_2O=C_6H_3(CH_3)_3+Cu_2O+N_2+2SO_4H_2.$$

The free hydrocarbon showed all the characteristic properties of that detected by Beilstein and Kögler in coal-tar, or prepared synthetically from bromised xylols by Fittig, Jannasch, Ernst, and Laubinger. In order to determine the position of the amido-group in pseudocumidine, the cyanide of the hydrocarbon $C_6H_2(CH_3)_3CN$ was prepared by treating a solution of diazopseudocumenechloride with copper sulphate and potassium cyanide. After saponifying it with an alcoholic potash solution, the acid formed, durylicacid, $C_6H_2(CH_3)_3COOH$ was liberated by adding sulphuric acid and distilling with steam. The durylic acid thus obtained is identical with that prepared by Jannasch, from pseudocumene; and whereas on the one hand there can be no further doubt that commercial cumidine is identical with Schaper's pseudocumidine, we obtain on the other hand a new argument for the presumption that the position of the substituents $NH_2:CH_3:CH_3:CH_3$ is 1 : 2 : 4 : 5, as Schaper has shown for his amido-compound.—S. H.

Derivatives of the Two Isomeric α-and β-Napthol azobenzenes. L. Margarry. Gazz. Chim. 14, 271.

Two isomeric monobromo derivatives are formed by the direct action of bromine on an acetic acid solution of α-naphtholazobenzene. They are analogous to those obtained from β-naphtholazobenzene, and correspond to the two isomeric α-naphthol-azobenzenes described by Typke. They melt at 185 and 195-196° respectively, and do not resemble the brom derivatives of β-naphthol-azobenzene in their solubilities. By reduction with tin and hydrochloric acid parabrom aniline and amido α-naphthol were obtained.—S. R.

Improvements in the Manufacture of Colouring Matters. Gerard Wenzeslaus von Nawrocki, Berlin. From Paul Böttiger, of Lodz, Russia. Eng. Pat. 4415, March 5, 1884.

This invention claims the series of colouring matters produced by combining tetrazodiphenyl with α- and β-naphthylamines and their sulphonic acids. The first compounds which have the formula

$$\begin{array}{l} C_6H_4.\ N_2.\ C_{10}H_6.\ NH_2(\alpha \text{ or } \beta) \\ | \\ C_6H_4.\ N_2.\ C_{10}H_6.\ NH_2(\alpha \text{ or } \beta) \end{array}$$

are insoluble in water, but soluble in alcohol, and are made soluble by conversion into their sulphonic acids, or the naphthylamines can be first sulphonated, and then combined with the tetrazo-salt in the usual way. The colours are of various shades of red, and are especially useful for cotton dyeing.—R. M.

Improvements in the Preparation of Purple, Blue, and Green Colouring Matters suitable for Dyeing and Printing, from Halogen-Derivatives of Tetramethyldiamidobenzophenone and Analogous Ketone Bases. John Henry Johnson, London. From Dr. H. Caro, Ludwigshafen, Germany. Eng. Pat. 5038, March 18, 1884.

The colouring matters described are all triphenylmethane derivatives or allied bodies, and the haloid-ketone derivatives are prepared in the manner described in a previous specification (Eng. Pat. 4850, 1884). In order to bring about condensation between these ketone halogen derivatives and aromatic bases it is not necessary to isolate the haloid derivatives in the first instance, but the two operations can be carried on at once by mixing the ketone base, the deoxidising and halogenising agents and the aromatic base. The five following examples illustrate the application of the process to the production of purple colouring matters :—(1) Tetramethyldiamidobenzophenone (10 parts) is mixed with twice its weight of dimethylaniline, and heated to 100° C., and when cool mixed with six parts of PCl_3. The halogenising action first occurs, and then condensation takes place with the dimethylaniline producing "methyl purple," the salts of which are crystalline. (2) Oxychloride of phosphorus is employed, and the order of mixture reversed, 25 parts of dimethylaniline being mixed with 10 parts of the oxychloride, and then 10 parts of dry powdered tetramethyldiamidobenzophenone gradually added, the whole mixture being finally heated to 90-100° C. By employing carbon oxydichloride as the halogenising agent, a complete synthesis of "methyl purple" can be effected in a combined series of operations from tertiary alkalised derivatives of aniline and its homologues. Bluer shades of purple are obtained by using tetraethyl instead of the tetramethyl ketone. (3) The tetraethyldiamido ketone is in this process condensed with dibenzylaniline by means of phosphorus oxychloride, the final product being "benzyl violet." (4) A phenylated "methyl purple" is produced by condensing the tetramethylated ketone with diphenylamine by means of phosphorus trichloride, toluol being used as a solvent. The salts of this colour, and of the corresponding compound from methyldiphenylamine, are soluble in hot water. (5) Purple colouring matters are also obtained by condensing the tetramethyl ketone with dimethylanisidine (ortho) or tetramethylmetaphenylenediamine. Blue colouring matters of the same series are obtained by condensing the haloid derivative of ketone base with tertiary alkylised derivatives of α-naphthylamine, such as dimethyl-α-naphthylamine, which gives a purplish blue, or phenyl-α-naphthylamine, which gives a bright, pure blue. In a similar manner green colouring matters are produced by the condensation of the haloid derivatives of the ketone base, with quinoline. Tetraethyldiamidobenzophenone gives a yellower shade of "quinoline green" than the tetramethyl derivative.—R. M.

Improvements in the Manufacture of Yellow Colouring Matters. Fritz Machenhauer, Reddish, near Manchester. Eng. Pat. 5158, March 26, 1885.

These colouring matters are prepared from triphenylated derivatives of rosaniline; more especially the blue produced by the action of aniline upon aurine known as "azuline." Two methods are given for converting "azuline" into the desired yellow dyestuff :—(1) The glacial acetic acid solution of the blue is acted upon by nitric or nitrous acid. (2) The sulphonic acid of "azuline" is acted upon by nitric or nitrous acid.—R. M.

Improvements in the Preparation of Yellow Colouring Matters suitable for Dyeing and Printing from Tetramethyldiamidobenzophenone and Analogous Ketone Bases, or their Halogen Derivatives. John Henry Johnson, Lincoln's Inn Fields, London. From Dr. H. Caro, Ludwigshafen, Germany. Eng. Pat. 5512, March 26, 1884.

These colouring matters, for which the inventor proposes the name of "auramines," are produced directly by the action of ammonia upon the CO group of tetramethyldiamidobenzophenone, or indirectly by the action of ammonia upon the halogen derivatives of the ketone bases. For the carrying out of the direct method, a salt of ammonia must be employed, and heat is necessary to bring about the reaction. Thus, 10 parts of dry, finely powdered tetramethyldiamidobenzophenone, 10 parts of salammoniac, and 10 parts of dry zinc chloride, are mixed and heated in an enamelled iron pan in an oil-bath to about 200° C (outside temperature) for 5-6 hours, till a sample of the melt dissolves completely in hot water. The hydrochloride of the colouring matter, after purification, is crystalline. The indirect method, which is the less advantageous, is carried out by chlorinating the tetramethyl ketone in nitrobenzene solution, by means of oxychloride of phosphorus, and then acting upon the product with ammonia of 0·95 sp. gr. The auramines are all basic dyes, the free bases being colourless, and the salts yellow without any fluorescence in solution. These compounds are decomposed by boiling with strong acids, or with water, ammonia and the original ketone base being regenerated.—R. M.

Improvements in the Preparation of Yellow, Orange, and Orange-Brown Colouring Matters, suitable for Dyeing and Printing from Tetramethyldiamidobenzophenone and Analogous Ketone Bases, or their Halogen Derivatives. John Henry Johnson, London. From Dr. H. Caro, Ludwigshafen, Germany. Eng. Pat. 5741, March 31,

The colouring matters referred to are substitution derivatives of the "auramines" referred to in the previous specification. Three processes are given for their preparation :—(1) The auramines produced by the methods described in the former patent are heated with primary amines in precisely the same manner as when rosaniline is phenylated by the action of aniline. In this way phenyl, tolyl, xylyl, naphthyl, etc., auramines are produced. (2) Primary amines or their secondary methyl, ethyl, etc., derivatives are made to react upon the haloid derivatives of the ketone bases. (3) This method, which is the most direct and economical, depends upon the action of aromatic amines upon the CO group of the tetra-alkylised ketone base. The invention is confined to aniline and its homologues, naphthylamine, chloraniline, meta and paraphenylene diamine, etc. These amines must be employed in the form of salts and heat is applied, the yield of colouring matter being greatest in the presence of zinc chloride. Phenyl-auramine, which may be regarded as a type of this class of colouring matters, is a bright orange-red powder, soluble in water, and decomposed by heating with acids into aniline and tetramethyldiamidobenzophenone. It produces orange shades upon wool or mordanted cotton. The corresponding colours from the diamines mentioned, and from the naphthylamines, give various shades of orange-brown.—R. M.

Process for the Separation of the Azo-Colours which are prepared from Diazotized β-Naphthylamine-monosulphonic acids by Combination with α-Naphthol-monosulphonic Acids. Dahl and Co., of Barmen. Ger. Pat. 30,040, May 20, 1884.

When a solution of an azo-dye is prepared by the action of the diazotized difficultly soluble β-naphthylamine-monosulphonic acids on the α-naphthol-monosulphonic acids, which correspond to the naphthionic and naphthalidamic acids, an azo-dye separates out either directly or on addition of a little salt. This azo-dye is derived from the β-naphthylamine monosulphonic acids marked I. and II., and already referred to in Ger. Pat. 29,084. In the filtrate the dye of the III. or new β-napthylamine-monosulphonic acid, remains in solution, and can be separated by salting out.—W. S.

An Improved Method of Preparing Alizarin and other Anthracene Colouring Substances. William Edward Gedge, London. From Gustav Jagenburg, Sweden, and Dr. C. Leverkus and Sons, Leverkusen, Germany. Eng. Pat. 15,456, November 24, 1884.

The object of the present invention "is to obviate the expensive and troublesome oil impregnation," the colouring matters being rubbed in the dry state with oils or fat so as to prepare them for printing.—R. M.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Improvements in the Treatment of Vegetable and other Tissues or Fibres for the Purpose of Preserving or Waterproofing the same. Arthur William Lovell Reddie. A Communication from Messieurs' Dillies & Co. Eng. Pat. 5317, March 22, 1884.

The process of preserving does not present any novel feature, as it simply consists in soaking the article in a solution of tannic acid derived from gall-nuts, sumach, etc. To render tissues waterproof as well as imperishable they are, after being first treated as above, placed in a bath of the following composition until thoroughly saturated :—

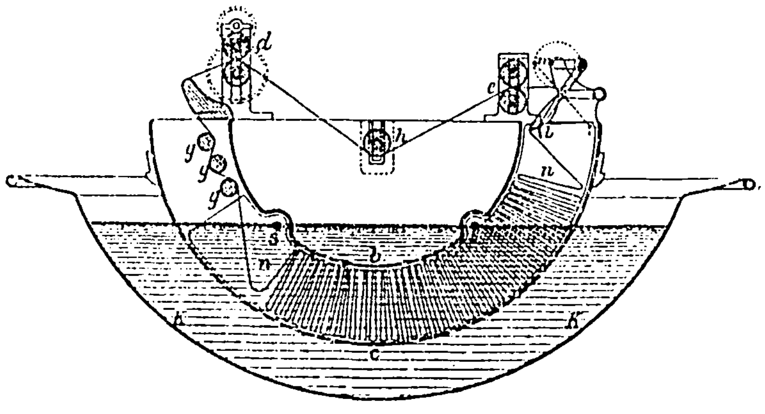
Linseed oil	500	Litres.
Birchbark distilled oil	20 to 25	„
Yellow litharge (litharge jaune)	1 to 2	Kilos.
White lead	1 to 2	„
Talc	1 to 2	„

In certain cases 1 to 4kilos. sulphate of iron may be added. These constituents are well mixed and boiled until everything is completely dissolved. The bath is then allowed to cool down to 200° F., and 10 to 20kilos. of animal or mineral wax added.—E. J. B.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

Vat Appliance for Dyeing Fabrics in an Unstretched Condition. Dingl. Polyt. Journ. 1884, 254, 207.

An apparatus by means of which the cloth may be passed through the dye-bath in an unstretched state, so that the liquor can freely circulate around it, and which conducts the cloth through the vat in an even and uniform manner, leaving it at the same time exposed to view where it enters and leaves the former, has been patented by F. Braun, of Vogelsmühle, near Lennep (Ger. Pat. 27,560, Nov. 25, 1883). A mould-shaped conducting channel formed by the two half round perforated sheets *b* and *c* and two movable side walls *n* (the distance between which can be adjusted by means of the screw spindles *s* to suit the width of the cloth to be dyed) is suspended in the vat K. The cloth is in front of the rollers *d* attached to an endless web which continually remains in the apparatus, and after passing through the rollers *e* is folded by the attachment *l m*. It is then being conducted through the dye-bath in a folded condition. The whole apparatus rests on the rim of the dye-beck and is easily removable. The gearing is fixed to the latter, and is by means of a coupling connected with the driving shaft situated above the rollers *d*.—F. M.



Preparation or Compound to be employed in the Finishing or Surfacing of Printing Rollers and Blocks, and other Articles. A. Barrett, London. Eng. Pat. 4153, February 29, 1884.

The emery wheels and lumps of pumice stone, which have hitherto been employed for this purpose, leave the surfaces with burrs, and less smooth and even than is desirable. The inventor employs pumice stone, broken into small pieces or powdered, and mixed with a sufficient quantity of plaster of Paris to agglomerate it into a solid mass, capable of being moulded into any required shape. The plaster of Paris may be replaced by other materials, provided that they are not harsh or gritty.—E. G. C.

Machinery, etc., for Bleaching, Dyeing, Sizing, or Washing Hanks of Yarn. Peter Thomas, Manchester. Eng. Pat. 6043, April 7, 1884.

The vats in which the various operations are to be performed are arranged side by side in a row. Rails are laid on each side of the series of vats, on which a carriage runs, and may be stopped at any required vat. This carriage supports a framework by means of shafts at the top of the carriage, provided with pulleys and ropes. These ropes are at one end connected with the framework and counterpoised at the other end, so that the frame may be lowered into and raised out of such vat as the carriage may be over. Removable cross-bars, which two by two are arranged to take a number of hanks, are carried on each end respectively by two longitudinal bars, and these latter are suspended from two shafts, forming a part of the framework, by means of levers working on eccentrics and fixed on the shafts. The eccentric motion imparts a reciprocating motion to the longitudinal bars, thus causing the cross-bars to change their respective position continually from a higher to a lower level, and so the yarn is kept in constant agitation in the liquor. The various parts are suitably connected, so that the carriage may be run to any required vat, the framework lowered, and the eccentric motion being brought into action the hanks on the cross-bars are agitated in the liquor contained in the vat. When the operation is over, the framework is raised and the carriage run to such other of the vats as is next required. (Drawings given.)—W. E. K.

Dyeing Garments, etc. Joseph P. Delahunty, Pittston, Pennsylvania, U.S.A. Eng. Pat. 11,231, August, 13, 1884.

A LARGE revolving octagonal reel or cage, the faces and ends composed of open slab work, is supported on its axis over the dye-vat. On the interior surface a series of pins project from the periphery towards the axis of the wheel, and a door is provided for the insertion and removal of the goods. The lower half of the cage only is immersed in the liquor, and, on the rotation of the reel, the goods are caught by the pins and carried forward, and are dropped again into the liquor when that part of the reel reaches its highest point. For removal of the goods a screen is inserted extending from the axis to the periphery of the reel, and by a revolution of the cage the goods are brought up on this to the surface. (Drawing given.)—W. E. K.

VII.—ACIDS, ALKALIS, AND SALTS.

On Pyrosulphates. H. Schulze. Ber. 17, 2705.

THE author has prepared salts of pyrosulphuric acid by the action of sulphuric anhydride on sulphates at ordinary temperatures, a method similar to that adopted by R. Weber. The author in the present paper confirms the results so far attained by R. Weber, and adds some new observations of his own. In the first place he found that sulphuric anhydride acts readily upon potassium sulphate at ordinary temperatures, a fact about which chemical literature contains conflicting views. R. Weber employed a closed tube and a high temperature. The author, on the other hand, found that the dry sulphate absorbs sulphuric anhydride with a considerable evolution of heat. The experiments were made with rectified sulphuric anhydride and 20 to 50grm. of finely powdered sulphate. The sodium, ammonium silver and thallium salts absorb the anhydride with even greater energy than potassium sulphate. In order to completely convert the sulphate into pyrosulphate, a higher temperature was necessary, the method employed being to soak the sulphate with the anhydride and distil off the excess at 100° to 120°. It is doubtful if Weber's octosulphates can be obtained by this method, as at the relatively high temperature employed for eliminating the excess of SO_3, the disulphate was invariably formed. Pure potassium pyrosulphate was prepared in this way. In the preparation of the sodium salt the product contained only 85 per cent. of pyrosulphate. The ammonium, like the potassium salt, can be obtained pure by the above method. Pure disulphate of silver and thallium are formed by simply mixing the sulphates with SO_3. In addition to these barium, strontium, calcium, magnesium, zinc and lead absorb sulphuric anhydride and form pyrosulphates. The purity of the product, however, varies, zinc and lead especially being only capable of taking up a comparatively small quantity of the anhydride. It is quite possible that Weber's method may give the pure compounds. The salts of magnesium and the alkaline earths gave, on analysis, results corresponding to the pure disulphates. The method of Berzelius for preparing pyrosulphates, that is, by heating the hydrosulphates, was next tried, but gave unsatisfactory results. A better method is to heat sulphates with chlorosulphuric acid. Schiff had previously prepared the potassium salt by this reaction—

$$K_2SO_4 + SO_3HCl = K_2S_2O_7 + HCl.$$

Experiments showed that an excess of chlorosulphuric acid is necessary, and this is afterwards distilled off. In this way the sodium ammonium and barium salts are readily prepared.—J. B. C.

Action of Ferric Oxide on Sulphates at a High Temperature. Scheurer-Kestner. Compt. Rend. 99, 876, 877.

WHEN two parts of gypsum are heated to a bright redness with one part of ferric oxide, sulphuric anhydride is given off and a mixture of lime and ferric oxide is left from which the lime can afterwards be removed by acetic acid. Probably the mixture first fuses and forms ferric sulphate, which is decomposed when a higher temperature is reached. By mixing 175 parts of gypsum with 100 parts of fluorspar and ferric oxide, the decomposition takes place at a lower temperature (that of a Bunsen burner), and the sulphuric anhydride formed is prevented from being dissociated into sulphurous acid and oxygen. Lead and magnesium sulphates behave in a similar way to calcium sulphate.—S. R.

Action of Lead Hydrate and Silver Oxide on Aqueous Solutions of Sodium Pentasulphide and Sodium Dithionite. A. Geuther. Annalen, 226, 232-240.

AT ordinary temperatures lead hydrate reacts with the pentasulphide in the following way:—

$$3Na_2S_5 + Pb_3O_4H_2 + 2OH_2 = 6NaOH + 12S + 3PbS.$$

Silver oxide reacts in an analogous way, but a secondary reaction, resulting in the formation of a definite quantity of sulphuric acid from the action of the silver oxide on the finely divided sulphur, also takes place. With sodium dithionite, the changes which take place are represented by the following series of equations:—

$$1.—S_2O_3Na_2 + Ag_2O = S_2O_3Ag_2 + Na_2O.$$

$$2.—S_2O_3Ag_2 = Ag_2S + SO_3.$$

$$3.—SO_3 + Na_2O = Na_2SO_4.$$

From these reactions the author considers that the name dithionite should be given to $Na_2S_2O_3$, as the name thiosulphate conveys the idea that the oxygen has been replaced by sulphur.—S. R.

Preparation of Hydrochloric Acid free from Arsenic. H. Beckurts. Arch. Pharm. 22, 684.

COMMERCIAL hydrochloric acid said to be free from arsenic contains generally distinct traces, and cannot therefore be used in judicial chemical cases. The acid, however, can be easily purified by distillation with ferrous chloride, all the arsenic coming over in the first portion of the distillate and more readily if the acid is concentrated. A solution of ferrous chloride is added to a 30 to 40 per cent. acid, the first 30 per cent. of the distillate contains arsenic and the remaining 60 per cent. is collected separately, and is quite pure. In this way a 20 to 30 per cent. acid is obtained. This method can be used technically for preparing hydrochloric acid free from arsenic. Further, arsenic can be detected when present in small quantities, by distilling with ferrous chloride and testing the first portion of the distillate.—J. B. C.

Improvements in the Treatment of Sulphate of Ammonia, for obtaining the Ammonia in the Free State and utilising the Sulphuric Acid. E. Carey, H. Gaskell, jun., and F. Hurter. Eng. Pat. 2118, Jan. 25, 1884.

THE object of this invention is accomplished by mixing intimately sulphate of ammonia and sulphate of soda, in equivalent quantities, and heating the mixture to the point of fusion. Super-heated steam is then introduced into the fused mass. At about 500° F. a decomposition begins, by which free ammonia and hydrogen sodium sulphate (bisulphate of soda) are produced. To hasten the reaction the temperature is gradually raised to from 700° to 800° F. The operation of heating is best carried on in a revolving cast-iron cylinder, heated outside by an open fire. The steam is admitted through a hollow agitator shaft, which rotates in the cylinder, the steam assisting the agitation at the same time. The ammonia set free by this treatment passes away from the cylinder, together with the steam, through an apperture in the cylinder, and is conveyed by pipes into condensers. The steam hastens the reaction by removing the ammonia from the charge as soon as liberated. If steam be admitted before the fusion of the mixed salts, too much sulphate is volatilised as such. The volatilised sulphate is absorbed in water and used over again. By the introduction of the steam into the fused mass, the formation of pyrosulphate is avoided. The pyrosulphate of soda decomposes ammonia producing nitrogen, consequently causing loss of ammonia. The bisulphate of soda produced in this process is proposed to be used for the decomposition of common salt, and for the production of hydrochloric acid.—C. C.

Improvements in and appertaining to the Manufacture of Sodium Bicarbonate. L. Mond and G. Jarmay. Eng. Pat. 2996, February 9, 1884.

DESCRIBES a method for converting the sludgy precipitate of bicarbonate of soda, obtained by the ammonia-soda process, into a more granular material, to facilitate the removal from it of ammonia and other impurities. For this purpose the crude salt is dissolved in warm water of about 60° C. and the solution allowed to cool, pure bicarbonate separates and all the ammonia remains in solution. The operation of cooling the solution of bicarbonate is varied, in the well-known manner, according to the size of grain desired to be obtained for the crystals. The mother-liquor is separated from the crystals by centrifugal machines. The solution of the crude bicarbonate of soda is best effected under pressure in an atmosphere of carbonic acid. A higher temperature may be employed in this case without decomposing the bicarbonate, but the solution requires to be cooled down to 65° C. before being run off. The mother-liquors may be used several times for washing and dissolving fresh crude salt.—C. C.

Improvements in and Relating to the Manufacture of Salt from Brine. G. S. Hazlehurst. Eng. Pat. 3015, February 9, 1884.

ACCORDING to this specification common salt is precipitated from brine by the addition thereto of chloride of calcium or of any other innocuous salt more soluble than common salt. If the solution of precipitant be hot and strong, salt of a fine grain is precipitated from the brine, if cold and of only slightly higher specific gravity than the brine, salt of a coarser grain is obtained. The salt is freed from the precipitant by washing. The liquid is reconcentrated and used over again for the same purpose. —C. C.

Improvements in the Treatment of Sulphurous Oxide in the Manufacture of Sulphurous Acid (H_2SO_3), Sulphites or Bisulphites. H. E. Scholefield. Eng. Pat. 3059, February 11, 1884.

CONSISTS in the application of an injecting apparatus for drawing off the sulphurous anhydride from sulphur burners or pyrites burners, and forcing it through coolers, and through scrubbers and washers (to remove arsenic and other impurities), into the absorbing apparatus. The injector may be worked by steam, air, or some other gas. The SO_2, after being cooled and after the condensation of the steam accompanying it, passes into the absorbing vessels, in which it is taken up by water to which lime or other alkaline oxide, or hydrate, has been added. For the absorbing vessel a high column may be used and the basic material fed in at the top, and extracted at the bottom fully sulphited. If sulphites are wanted no water is used, but the gas is passed through shallow layers of the alkali or alkaline earth. —C. C.

Improvements in the Manufacture of Bichromate of Soda. W. J. Chrystal. Eng. Pat. 4028, February 27, 1884.

FOR the purpose of manufacturing bichromate of soda free from other salts of soda, the inventor evaporates the solution, which is obtained by adding to the solution of neutral chromate of soda the necessary quantity of sulphuric, muriatic, carbonic, nitric, acetic, or other acid, until the respective salts of sodium—viz., sulphate, nitrate, chloride, carbonate, etc.—are salted out and eliminated. The solution then contains only bichromate of soda, which crystallises out on cooling. The composition of the crystals is represented by the formula—

$$2Na_2Cr_2O_7 + 5H_2O.$$

By evaporating the solution of bichromate beyond the point at which the other soda salts are eliminated, crystals containing less water may be obtained. By evaporation to dryness and subsequent fusion, bichromate of great purity is obtained.—C. C.

Improvements in the Manufacture of Bichromate of Soda. C. S. Gorman. Eng. Pat. 4198, March 1, 1884.

250 PARTS by weight of chrome iron ore, 80 parts of chloride of sodium, 100 parts of sulphate of soda, and 250 parts of hydrated lime are placed in a furnace and subjected to the action of steam superheated to from 1000° to 1600° F. The hydrochloric and sulphurous acids evolved are conveyed to condensers. The finished charge in the furnace is treated in the usual manner. To the chromate of soda solution sulphuric acid is added to convert the same into bichromate of soda. The solution is then placed in coolers, chloride of sodium and sulphate of soda separate out on cooling. After this the solution is evaporated, the evaporation being completed by blowing air heated to from 400° to 700° F. into the liquid.—C. C.

Improvements in the Manufacture of Bichromate of Soda. C. S. Gorman. Eng. Pat. 4929, March 15, 1884.

IN this invention neutral chromate of soda is treated with hydrochloric acid gas. The neutral chromate of soda is converted thereby into bichromate, and the chloride of sodium formed at the same time is thrown down as insoluble and separated from the liquid, thus saving evaporation of the bichromate solution.—C. C.

Improvements in the Manufacture of Cream of Tartar. F. Wirth. Eng. Pat. 4362, March 4, 1884.

THE object of this invention is the production of cream of tartar direct from crude tartar or argol. The argol is dissolved in boiling water or mother-liquor, to which about 15 per cent. (of the weight of argol) of phosphoric acid is added. The solution is then decolourised with animal charcoal or the like, and cleared by the addition of pipeclay. To remove the small traces of iron, copper and other bodies remaining in the clear solution, a small amount prussiate of potash (½% to 1%) is added, after which the solution is allowed to settle. The clear solution is then allowed to crystallise, and yields large, bright, colourless, almost chemically pure crystals. The mother-liquor is used for dissolving fresh quantities of argol, and the quantity of phosphoric acid which has disappeared from the same (by having formed precipitates of iron and alumina in the previous operation) has to be replenished.—C. C.

VIII.—GLASS, POTTERY, AND EARTHENWARE.

Machinery for and Method of Preparing Potters' and other Clays. J. H. Key, Newton Abbot. Eng. Pat. 2538, February 1, 1884.

THE various kinds of clay to be operated upon are first dried in the usual manner and then placed in the desired proportions in the different removable divisions of a wooden shoot, leading to a wooden box, furnished with corresponding removable divisions, and with a hinged bottom divided into two or more parts. This box or truck receives the clays, and is then drawn up an incline, by means of a rope or chain winding upon a drum, to the top of a machine for breaking up the clays. This is provided with an ordinary hopper, in the middle of which is a revolving vertical shaft carrying knives. The bottom of the truck falling, the clays drop through an opening near the top of the incline into the hopper, where they are mixed together and the lumps broken up. The clay broken by the knives falls on to a horizontal screen, made of perforated steel bars, parallel and very close to each other, on which it is crushed small by rollers attached to the vertical shaft and covered with rubber or other elastic material. When crushed sufficiently small, the clay is swept from the surface of the screen into a sifter by series of movable brushes and scrapers, also attached to the shaft and capable of being set to any angle. The sifter consists of an upper and second sieve of wire-gauze, placed in an inclined position and shaken by cranks connected with a horizontal shaft. The finer particles of clay pass through both sieves and fall into a trough beneath, from whence they are conveyed by a revolving worm to the pugmill. The coarser particles, together with the coarse impurities, are caught by the upper or first sieve, and fall into a water tank, where the impurities separate to the bottom, and from which the clay and water are pumped into a "water-sifter." The water-sifter also receives the smaller particles of clay and impurities caught by the second sieve. Two or more sieves of wire-gauze and graduated fineness, working in water, in an inclined position, constitute the water-sifter, by means of which the coarser particles of clay are reduced to a fine state of division, and the remaining impurities finally separated. The "slop" clay is now raised by a pump or elevator to the revolving worm, along which it passes for a short distance, partially mixing with the dry powdered clay, and from thence to the pugmill.—E. G. C.

Improvements in the Manufacture of Imitation Stained Glass for Decorative Purposes. W. Cunliffe, Hornsey. Eng. Pat. 5080, March 18, 1884.

The objects of this invention are to overcome the various defects in previously devised methods of imitating stained glass, and to produce a "permanent and perfect substitute" at a very small cost. The required designs are executed in colours or monochrome, upon thin unglazed tracing paper or some other suitable medium, which is then saturated with a solution of bichromate of potash, chrome alum, or other chromate, with a gelatinous solution, as of glue or gelatine, and with a solution of shellac, mastic, or other gum, in turpentine or spirits of wine. The tissue is then thoroughly dried and placed between two adjacent sheets of glass, which are firmly held in position and subjected to a "gentle and gradual heat until the proper point of cementation is reached." When cold they firmly adhere together and are free from all air-bubbles and drops of liquid between the glass and tissue. The finest transparent colours in tubes, such as carmine, ultramarine, Prussian blue, raw and burnt sienna, Vandyke brown, etc., are preferred; but the aniline colours and others may also be used effectively.—E. G. C.

Method of and Apparatus for Drying China, Clay, and similar Materials. J. Lovering and J. Bell, St. Austell. Eng. Pat. 6252, April 10, 1884.

According to this invention, a chamber is constructed of any desired length, width, and depth, and perfectly air-tight except at its top, which top forms the drying pan, and is composed of porous tiles or specially formed bricks, which are laid upon iron bars placed transversely over the air-chamber. The tiles are from 12-24in. long, about 4in. thick, and they vary in breadth as may be desirable; they are cemented or otherwise secured together. If bricks be used, they are about 1ft. long, 2½in. wide, and 6in. deep; their sides are vertical for about 2in. down, and are then bevelled off, so that when two bricks are placed side by side there shall be a wedge-shaped space between them open to the air-chamber. The bricks are placed end to end on the bars, the ends being cemented or otherwise secured together; but the sides must be made to fit together accurately, no cement or other material being placed between them. Into the air-chamber so formed heated air is forced by any convenient means. It finds its way through the porous tiles or the crevices between the bricks, and through the wet clay placed on the pan to be dried, thereby driving off the moisture, and effectually and speedily drying the clay. If desired, cold air may be forced into the chamber and there heated. By the use of the apparatus described clay will be dried much more quickly than by the usual method and without any risk of burning.—E. G. C.

Improvements in the Manufacture of Potters' Ware. J. & J. F. Maddock. Eng. Pat. 5460, March 26, 1884.

This invention consists in the manufacture of earthenware, china, and porcelain from plastic clay by means of plaster of Paris moulds incased in metal rings or cases, by pressure.—E. G. C.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, CEMENTS.

Kilns and Ovens for Economically Burning Limestone, Bricks, and Pipes, etc. H. Hargreaves, W. Beckett, and W. Cliff, Chester. Eng. Pat. 2368, Jan. 30, 1884.

The exhaust heat from ordinary lime-kilns is applied and utilised by passing it through flues into an oven or kiln, in which limestone, bricks, and pipes of a very superior quality can be burnt without fuel of any description. The ordinary open kilns are covered with fireclay slabs placed in iron frames on wheels running upon iron rails placed on each side of the open mouth of the kilns. "This process does away with any possibility of nuisance from smoke or fumes arising from the process of burning limestone, etc.," and the application of the covers, flues, and chimney to the old kilns was found by the inventor to result in a saving of 20 per cent. in fuel, the new oven not requiring any fuel.
—E. G. C.

Manufacture of Bricks, Paving Blocks, and the like from Blast Furnace Slag or Scoria. G. Patchett, J. Dixon and R. Teasdale, Durham and York. Eng. Pat. 3839, February 2, 1884.

The kilns in which the bricks, etc., are annealed are constructed with converging or sloping bottoms, and are arranged side by side in a circle or part of a circle, so that all the kilns of the series are situated under the rim of a wheel carrying the moulds or boxes for moulding the molten material. The moulds are provided with a flange or lip overlapping the space between every two consecutive moulds or boxes, in order that waste of slag or scoria may be avoided as far as possible.—E. G. C.

Improvements in the Manufacture of Bricks from Wet Clay. C. and W. Cooper, Great Crosby. Eng. Pat. 3737, February 22, 1884.

According to this invention, a column of clay issuing from the mouth or die of a pugging mill is cut by suitably arranged wires into blocks for burning into bricks, the machinery by which this is effected being so constructed that the wires descend through the clay at the same time that the latter is forced horizontally through the range of wires. The clay is thus sawn through, as it were, instead of being cut or torn apart, and the surfaces produced are smooth and even.—E. G. C.

Improvements in the Manufacture of Artificial Lithographic Stones. F. Wirth, Frankfort-on-the-Main. From Louis Rosenthal, Frankfort-on-the-Main. Eng. Pat. 3808, February 23, 1884.

The disadvantage attending the use of cement for the preparation of plaster, artificial stone, etc., has hitherto been the liability of the material to crack, in consequence of contraction produced by change of temperature. The admixture of sand with the cement has been found to answer for ordinary purposes, such as plastering walls or casting stone blocks, but not for polished surfaces or for imitation marble. This invention is claimed to offer the possibility of making artificial lithographic stones "equal in every respect to the natural ones, and in some respects superior, as they can be made to any required form." The process by which such a homogeneous cement-mass is to be produced is as follows: One half, or rather more, of the cement to be worked is made into a paste with water, and formed into thin plates, which are allowed to harden as quickly as possible, by the aid of heat if necessary. The hardness is increased by repeatedly moistening the plates with water and heating them until they appear full of cracks in consequence of the sudden changes of temperature to which they have been subjected. These plates are then ground to a fine powder and thoroughly mixed with the remaining portion of fresh unset cement. The mixture is transferred to a cast-iron mould of the desired shape, and therein exposed to a pressure of more than 20 atmospheres; the mould is divided into two compartments by a horizontal perforated plate covered with linen cloth. The quantity of water necessary to set the whole mass is now poured over it, and the air is exhausted beneath the perforated bottom by means of an air-pump or other convenient apparatus. In this way the water is sucked through the mass, all the air being removed and its place filled by the turbid fluid. Excess of water is eliminated, and the particles of the mass are caused to approach one another more closely by a second application of more than 20 atmospheres' pressure. Finally, a liquid containing in solution the alkaline and soluble constituents of cement, is prepared by agitating cement with 100 per cent. of water and pouring off the fluid containing the soluble portions. This liquid is forced through the solidified and hardened stone until "the most microscopic bubble holes are filled out by the soluble constituents contained in the water." The inventor states that repeated experiments have proved impressions taken from the artificial stone so prepared to be sharper than those taken from the natural Solenhofer stone. Such artificial lithographic stone requries no especial treatment with regard to applying colours or causticising, etc. The explanation of the effect of an admixture of already hardened cement with fresh unset cement in preventing shrinkage, is not clear, but it would appear that, by the addition of the former to the latter, a compound is formed which possesses less shrinking qualities than the cement by itself. Finely ground carbonate of lime can be substituted for the already hardened cement.—E. G. C.

Apparatus for Treating Clay to be used in the Manufacture of Bricks, Blocks, Tiles and Terra-Cotta. T. H. Sharpe, Ruabon. Eng. Pat. 4249, March 3, 1884.

The object of this invention is to beat, cut, pulverise and reduce clay, as dug from its bed or after preliminary treatment of any usual kind, to a finely divided and pulverulent condition suitable for being at once shaped into any desired article. This is effected by an apparatus constructed with a series of beater knives revolving past each other in opposite directions.—E. G. C.

Improved Apparatus to be used in the Manufacture of Cement. J. Watson, Greenhithe and Gateshead-on-Tyne. Eng. Pat. 4879, March 4, 1884.

The object of this invention is to separate flint and other similar hard substances, liable to injure the grinding machinery, from the "slurry" as it passes to the grinding apparatus. This is effected by causing the slurry to flow at intervals through a trough provided with stops or gates, behind which hard or heavy particles are deposited. A trap or well may be constructed behind each stop or gate, furnished with a double slide arrangement, so that deposited matter may be received into the well, and allowed to escape from thence without interruption to the flow of the slurry. The deposition of flinty and other heavy particles can be facilitated by giving a vibratory movement to the trough or passage. —E. G. C.

Improvements in the Manufacture of Cement. F. Ransome, Lower Norwood. Eng. Pat. 6517, April 18, 1884.

In a previous specification (No. 4664, 1878), the inventor recommended a method for the manufacture of cement by the calcination of slag sand with chalk or other calcareous matter. According to this invention the sand and chalk were to be ground, and then calcined together. The inventor now advises the admixture with the slag sand of lime in a caustic or hydrated condition; and for this purpose, spent lime which has been used in the purification of gas may be employed. Sulphur may be removed from the gas lime by adding to the mixture of lime and slag sand a small quantity of coal or coke before calcination. A jet of steam is introduced into the furnace during the ignition. A revolving or rotating furnace is employed, and the mixture, admitted in a state of fine powder, is kept in motion in the furnace; it is thus discharged after calcination in the state of powder, and ready for use without further grinding. —E. G. C.

An Improved Asbestos Compound especially applicable for Use as Boards or Sheathing for Roofings, Wearing Surfaces of Car Brakes, and for Building Purposes. Complete Specification. David Hunter Brandon. From Daniel Austin Brown and Charles Francis Brigham. Eng. Pat. 7304, May 6, 1884.

To prepare the improved compound asbestos, preferably in a fibrous form, is incorporated with oxide of magnesium, and then mixed with chloride of magnesium or any chemical equivalent, and the mass moulded to any desired form. To render the compound lighter, and also to cheapen it, vegetable fibre may be added.—E. J. B.

X.—METALLURGY, MINING, Etc.

Purification of Zinc containing Arsenic. Dingl. Polyt. Journ. 1884, 254, 400.

L'Hote (*Revue Industrielle*) has tested a number of samples of sheet and block zinc, and found all of them to contain arsenic, the quantity varying in the case of sheet zinc from 10·5 to 36 milligrammes per kilo., and amounting only to traces in the case of block zinc. An efficacious and quick method of purification consists in adding to the melted zinc from 1 to 1·5 per cent. of anhydrous magnesium chloride, and stirring it well up with it. All the arsenic is given off in the form of trichloride, and by pouring the metal into water it is obtained in a granulated condition, and perfectly free from arsenic. Contrary to that obtained by purification through melting with potassium nitrate and subsequent distillation, it is readily soluble in sulphuric acid. The same method of purification may be applied to zinc containing antimony.—F. M.

Carbon in Iron and Steel. F. A. Abel. Proc. Inst. Mech. Eng. 1, 1885, 30-57; and Engineering, 35, 187, 188.

Preliminary experiments were made to ascertain whether any characteristic differences could be established in structure or chemical condition between thin discs of steel cut from the same piece, but differing from each other in regard to the treatment to which they had afterwards been subjected. No light was thrown upon the mechanical structure of the different specimens by submitting them to the action of the solvent (a chromic acid solution), specially selected on account of its gradual action. Considerable differences were found to exist between the total amounts of carbon contained in different discs, from one and the same piece of steel, but in the hardened, tempered, and annealed states respectively. The proportion in the annealed steel was comparatively very low, and experiment showed that the reduction in the proportion of carbon, during annealing, was due to the prolonged exposure of the discs, 2·5in. diameter, 0·01in. thick, to heat in contact with, or in close proximity to, the wrought-iron plates between which they were confined. In a particular case the carbon was reduced from 1 per cent. to 0·1 by 24 hours, annealing between wrought-iron plates in a cast-iron box. The action of a chromic acid solution (cold saturated solution of potassium bichromate mixed with one-twentieth its volume of pure concentrated sulphuric acid) on the cold-rolled and annealed discs yielded, in different proportions, a black scaly or spangly substance, which was attracted by the magnet, and which was found to contain, in combination with the iron, an amount of carbon equal practically to the whole amount which had been found to exist in corresponding discs, in the same cold-rolled and annealed condition. On the other hand, a disc of hardened steel, similarly treated, yielded only a small quantity of dark particles of similar appearance, in admixture with some lighter coloured sediment, and the carbon in this residue amounted only to about one-sixth of the total carbon in this steel. The proportion borne by the carbon to the iron in this particular residue, was found to be decidedly higher than in the spangly residues furnished by the annealed samples. Chromic acid solutions of different strengths were employed in the following experiments; an excess of the solution was always employed. In some cases the steel, about 7grm., was supported on a perforated platinum tray in the upper portion of the liquid, but later perforated glass was substituted to avoid possible galvanic action. In the paper published, 1883 (*Engineering*, vol. 35), the author remarks:—On the whole these results appear to furnish some foundation for the belief that the material separated from cold-rolled steel by the action of a sufficiently dilute solution of chromic acid, contains an iron carbide approximating to the formula Fe_3C, or to a multiple of that formula. These results appear to confirm the view that the carbon in cold-rolled steel made by the cementation process exists, not as simply diffused mechanically through the mass of the steel, but in the form of an iron carbide—a definite product, capable of resisting the oxidising effect of an agent which exerts a rapid solvent action upon the iron through which this carbide is distributed. In the recent report (*Proc. Inst. Mech. Eng.*, above cited), it is stated that on examining a majority of the cold-rolled discs (series A, B, C and F) prepared from the same metal, it was found that variations, in some instances considerable, existed in the amount of total carbon in these. This circumstance much diminishes the value of the results furnished by these series of discs. It was suggested to anneal the discs when held between fire-clay blocks and packed in magnesia, instead of wrought-iron plates and soot, to avoid the decarbonising action shown to be caused by the plates; but no conclusive results were obtained by this method owing to the uncertainty as to the composition of the discs before annealing; further experiments in this direction are desirable. Reference is made to results obtained by F. C. G. Müller, who treated Bessemer steel in the cold with dilute sulphuric acid (one of acid to five of water). After 12 hours the black residue (found to be pyrophoric) was dried in coal-gas and found to contain from 6·01 to 7·38 per cent. of carbon, and Müller regards his "amorphous iron" as being probably Fe_3C. From the numbers given, 20 to 50 per cent. of the total carbon in the steel must have been converted into hydrocarbons. In the author's earlier experiments, with one kind of steel in one condition, when the steel was acted upon by a solution (potassium bichromate solution plus sulphuric acid) containing more than enough acid to dissolve its iron, together with combined oxygen, which was able to greatly diminish the formation of hydrogen, about 90 per cent. of the total carbon was left as insoluble carbide. The ratio of sulphuric acid to bichromate was kept constant, the proportion of bichromate in the solution being varied. Three experiments showed a good agreement both in amount and composition of the carbides left; the fourth showed that there was a limit to the stability of the carbides. In recent experiments the result of varying the ratio of the sulphuric acid to the bichromate was first tried; and then, for the remaining solutions, one uniform ratio (equal weights) between the sulphuric acid and bichromate was maintained. The steel operated on and its condition were also varied. The numbers obtained are put together in the accompanying table, and to a great extent explain themselves.

Method of Experimenting.—The weighed portion of steel (previously cleaned with emery, then with cold ether, and wiped) was dipped into the solution, stroked while moist with the finger, then placed on a glass sieve near the surface of the chromic solution contained in a capacious beaker. In the case of hardened steel much hydrogen was evolved. The solution was probably in all cases complete within 24 hours; the sieve was rinsed into the liquid, the latter stirred up, and allowed to stand for another 24 hours. After decantation and slight washing, some fresh chromic solution was added and shaken occasionally for 24 hours at least. After decanting on to a filter and washing with water, alcohol and ether, the residue was dried over sulphuric in vacuo and weighed. A correction for the small amount sticking to the filter was made by estimating the iron in it. As the amount of sulphuric acid affects greatly the yield of carbide, it was desirable, in the later experiment, to avoid the presence of large quantities. The number given in the table under the head of "free sulphuric acid sufficient for dissolving grams iron," was calculated from the following equations:—

$$(a)\quad K_2Cr_2O_7 + H_2SO_4 = 2CrO_3 + K_2SO_4 + H_2O.$$

$$(b)\quad Fe_2 + 2CrO_3 + 6H_2SO_4 = Fe_2(SO_4)_3 + Cr_2(SO_4)_3 + 6H_2O.$$

The solutions are, however, able to dissolve more iron than this calculated amount. With the exception of one or two darker preparations, which proved to be partly decomposed, all the carbides obtained were grey-black heavy powders, not at all pyrophoric at ordinary temperatures. The unfused cemented (L) Dannemora steel contained: Total carbon, 0·941 per cent.; silicon, 0·006 per cent.; manganese, 0·009 per cent. After experiments 1-5, a second portion gave: Total carbon, 0·913 per cent. Digested with hydrochloric acid, a residue of carbon unconverted into hydrocarbon amounting to 0·018 per cent. was obtained. The products of experiments 2, 3, and 4 are obviously decomposed carbides. The number for "percentage of total carbon in the steel obtained as carbide" is too favourable; the actual carbide is better given by the percentage of iron in these insoluble products. Experiment 4 shows that diluting a solution containing an excessive quantity of sulphuric acid, causes less decomposition of the carbide, but does not give a much improved result in the total obtained. Experiment 6 shows that a large excess of the chromic solution compared with the steel taken can be used without detriment.

Annealed and Hardened Steel.—Eight pieces were cut off, four were annealed in fireclay blocks and magnesia, and four hardened between planed cast-iron plates. The annealed steel contained 1·015 per cent., the hardened 0·995 per cent. of total carbon. The agreement in the amount of carbide obtained in 7 (12·8 per cent.) with the 12·5 per cent. furnished by the much stronger (in chromic acid) solution of 9, is of importance in connection with the experiments with the tempered steel. The three small quantities of carbide from the hardened steel were strongly attracted by the magnet, but there was not enough for analysis. Experiments 13 and 14 were made with discs of series F already mentioned. The halves of three discs were taken for experiment, the other halves were used for estimation of total carbon. In the case of the annealed specimens this estimation was lost, and the mean of three discs previously examined (1·140) had to be taken. The hardened halves contained 1·093 per cent. carbon. The important numbers for carbon, water, and for carbon not converted into hydrocarbons, agree well with the numbers given by the other annealed steels.

Tempered Steel.—The halves of three discs were used for experiment 15, and the other three halves for carbon estimation; and similarly for 16. The straw contained 0·928 per cent., the blue 0·917 per cent. of total carbon. In the repeat experiments 17 and 18, less carbide was obtained than in 15 and 16, it is not easy to see why. A lower yield of carbide from blue- than from straw-tempered steel was also not expected; the hotter blue discs may in some way have been chilled on removal from the tempering bath, considering the small weight and large surface of the discs. Experiments 19-34 were made with 24 discs of fused steel, each 0·01in. thick, and $2\frac{7}{16}$in. in diameter; they were cut from the same strip of steel. The halves of three discs were used for the estimation of total carbon, while the other halves were used for 22 and 23. "Straw, hot chamber 6 hours," gave 1·148 per cent.; and "blue metal bath, 15 minutes," gave 1·120 per cent. total carbon. The steel also contained 0·161 per cent. silicon, and 0·169 per cent. manganese.

Experiments 30 and 34 showed that the addition of water to the solutions did not affect the yield of carbide. The yield of carbide in experiment 22 was 2·52 per cent., which is inexplicable. The low number, 4·61 per cent., obtained in 24 may be set aside. Had these tempered steels behaved like annealed steel in leaving 90 per cent. of their total carbon as a carbide, containing 7 per cent. carbon, the yield of carbide would have been 14·5 per cent. The mean composition of the carbides obtained in the best experiments is given in the following statements, which include the mean of the three given in the report of January, 1883 :—

	Water.	Carbon.	Iron.
Cold-rolled steel, mean of experiments 1 to 6	0·93 %	6·92 %	92·77 %
Annealed steel, mean of experiments 7, 9 and 11	1·32 „	7·01 „	91·80 „
Tempered steel, mean of experiments 25, 26, 27, and 28	2·23 „	7·23 „	89·92 „
Cold-rolled steel, January, 1883, mean of preparations 1 to 3	2·09 „	7·12 „	90·87 „

Probably the greater part of the water in the carbide is present as a constituent of a carbo-hydrate, which is a product of decomposition of the carbide, as this increase in the proportion of water is attended by an increase of carbon and a decrease of iron.

The specific gravity of some of the specimens of carbide, and of the steel from which they had been prepared, is as follows :—

CEMENTED (L) DANNEMORA STEEL.

Specific gravity at 60° F. (Water at 60° F. = 1·00).

Steel cold-rolled	7·75	Carbide from cold-rolled steel	6·9
Steel annealed	7·67	Carbide from annealed steel Ex. 9	7·2
Steel hardened	7·61	Carbide from annealed steel Ex. 11	7·2

In estimating the total carbon in the steels by means of copper chloride, it was noticed that the "carbon" was left by the chloride in the following conditions :—By one cold-rolled steel, in a powdery form ; by two annealed steels, in powder; by one hardened steel, in plates and bulky ; by another hardened steel, in large plates ; by a straw-tempered steel, in bulky plates; by a blue-tempered steel, in bulky plates.

The author draws the following conclusions from his work :—(1.) In annealed steel the carbon exists entirely, or nearly so, in the form of a carbide of iron of uniform composition (Fe_3C, or a multiple thereof), uniformly diffused through the mass of metallic iron. (2.) The cold-rolled samples were very similar to the annealed steel in this respect. (3.) In hardened steel the sudden *lowering of the temperature* appears to have the effect of arresting the separation of the carbon, as a definite carbide, *from the mass of iron in* which it exists in combination, its condition in the metal being mainly the *same as when the steel is in a fused state.* (4.) In tempered steel the condition of the carbon is intermediate between *that of hardened and of annealed steel.* The maintenance of hardened steel in a moderately heated state causes *a gradual separation (within the mass) of* the carbide molecules, the extent of which is regulated by *the degree of heating, so that the metal gradually* approaches in character to the annealed condition ; but, even in the best result obtained with blue-tempered steel, that approach, as indicated by the proportion of separated carbide, is not more than about *half-way* towards the condition of annealed steel. (5.) The carbide, separated by chemical treatment from blue and straw-tempered steel, has the same composition as that obtained from annealed steel.

Discussion.

W. H. **Dugard** observed that Prof. Norris had found that very hard steel would dissolve in sulphuric acid without leaving any residue whatever, while annealed steel left a residue of carbon, exactly in the form of the original steel, and according to the different degrees of hardness so the amount of residue varied.

I. L. **Bell** on one occasion took a disc of malleable iron containing a mere trace of carbon, and had its surface planed and polished, and also a similar disc, in point of size, made of cast iron, which was also planed and polished. These two discs were screwed together and enveloped in molten cast iron, where they were kept for different periods, from a week to four weeks. He found that, without there being a trace of fusion, the carbon from the cast iron had passed as it were into the disc of malleable iron.

A. **Paget** remarked that seven of the thin steel discs had been bolted between a cast-iron plate on the one side and a wrought-iron one on the other, and the whole had been kept at a good red heat, short of fusion, for 24 to 36 hours. Judging by practical tests the one nearest the cast iron was the most steely, while the one nearest the wrought iron was least steely, and they followed a somewhat regular gradation from the first disc to the seventh.

Sir F. **Abel**, replying, said that twenty-five years ago he obtained results similar to those described by Mr. Dugard as having been obtained recently by Prof. Norris.
—J. T.

On the Oxidation of Copper. Debray and Joannis. Compt. Rend. 99, 688.

Copper becomes oxidized by heating it in air from 350° up to a temperature at which the dissociation of the oxide attains a tension of $\frac{1}{5}$ atmosphere, when cupric oxide is formed without passing through the intermediate state of cuprous oxide. Cuprous oxide is oxidized at a moderate heat even more rapidly than metallic copper. At a very high temperature cupric is converted into cuprous oxide.—J. B. C.

On the Decomposition of Copper Oxide by Heat. E. J. Maumené. Compt. Rend. 99, 757.

The author points out that the results of the experiments of Debray and Joannis must be regarded as incorrect, and states that an intermediate oxide of copper exists between cuprous and cupric oxide, having the formula Cu_5O_3 soluble in acids with a brown colour, whereas Cu_2O gives a colourless, and CuO a blue or green solution ; and further that Cu_5O_3 colours glass a brilliant red, Cu_2O producing no change, and CuO a green colour. From his "general theory" the author derives a series of complicated intermediate oxides of CuO and Cu_2O.—J. B. C.

An Improved Method of Manufacturing Metals and Metallic Alloys. John Lewthwaite, Halifax, England. Eng. Pat. 3240, February 13, 1884.

This is an addition to or completion of a former patent by the same inventor (No. 1553, March 27, 1883), and refers to the admixture of titaniferous or other metallic sands or refractory ores of suitable properties with molten metals for the purpose of producing improved or purified metals or alloys. The claim is for the production of a superior class of iron, steel, bronze or other metallic compound by the introduction into the clear molten metal or metals of titanic sand or ore or other ores containing certain mineral acids, such as titanic, manganic, silicic, etc., in a finely comminuted form, in which they are in the fittest state to produce an electro-chemical combination.—B.

Improved Means for Preventing Galvanic Action in Iron and Steel Ships when Protected by Copper or other similar Sheathing; applicable also to other like Submerged or Partially-submerged Surfaces. B. L. Thomson, London. Eng. Pat. 4658, March 10, 1884.

The iron or steel surface to be protected is coated with a vitreous layer (as of sodium silicate or other materials which will form glass when subjected to the action of heat), to which the sheathing plates are affixed by means of india-rubber solution or otherwise. "A layer of india-rubber or cork, felt, paper or canvas, or the like saturated with india-rubber solution is preferably interposed between the sheathing plates and the surface of the metal to be protected." When the sheathing plates are secured in position the vitreous coating surrounding their edges is heated by means of a blowpipe or otherwise, so that the vitreous material may cover the joints and thus produce a perfect junction impervious to moisture. Galvanic action is by these means entirely prevented.

—E. G. C.

Improvements in the Manufacture of Chromium Alloys. Thomas Slater, Bayswater, London. Eng. Pat. 9460, March 21, 1884.

The object of the inventor is to produce alloys of chromium in an economical manner so as to make them more readily available for use in the arts. He takes chromate of potash or other salt of chromium, or chromic acid, mixes them with an equal weight of charcoal in coarse grains, and heats them together in a covered crucible. When the mass has been softened by heat he pours thereon about two-and-a-half times its weight of molten copper, and further adds from one-half to two parts in weight of molten tin. After thoroughly heating and stirring together for some time the mixture is poured into water for the purpose of reducing or disintegrating the same. The resulting granulated mass is then remelted with a flux of the following composition—viz., one part of biborate of soda, two parts of nitrate of potash and two parts of carbonate of potash, when it is cast into moulds, plates, ingots, etc., for employment in the arts. It will then be found to have a rich golden yellow colour, but if a white alloy be required it can be produced by the addition to the chromium salts or oxides of metallic nickel mixed with tin and with copper in suitable proportions.—B.

A Method of Producing Alloys of Iron or Manganese or Iron and Manganese with Tin. Charles Billington and John Newton, Langport, Staffordshire. Eng. Pat. 5345, March 24, 1884.

The inventors claim the introduction of iron or manganese, or of iron and manganese not previously alloyed, into a bath of molten tin kept at a suitable temperature, the iron or manganese being connected by wires to a dynamo machine or battery. When put in circuit it is claimed that the current of electricity throws off the iron or manganese or iron and manganese into the tin bath, and produces chemical action between the metals, which causes them to alloy with each other in any desired proportion that can be regulated with great nicety.

—B.

Improvements in the Manufacture of Metallic Alloys. George Alexander Dick, Cannon Street, London. Eng. Pat. 6172, April 9, 1884.

The object of the invention is to produce manganese copper in a readier and less expensive way than at present. For this purpose pure copper is melted in a crucible with ferro-manganese containing a large percentage of manganese, and in the presence of silicium. When pouring out into ordinary moulds, the manganese will be found to have combined with the copper, and the silicium with the iron, the latter forming a layer upon the manganese copper. The greater the amount of silicium present the more perfect is the separation, though even so small a quantity as 1 per cent. of silicium as compared with the manganese present suffices for the desired effect. In some cases the ferro-manganese contains in itself sufficient quantity of silicium to produce the necessary reaction upon the iron so as to set the manganese free to combine with the copper.—B.

Improvements in the Treatment and Production of Iron, and in the Apparatus employed therefor. Samuel Richard Smyth, Surrey. Eng. Pat. 8583, June 4, 1884.

The inventor proposes to produce in a single heat, from indifferent materials and with a low pressure of blast, iron of the best quality, ready for the rolling mill or hammer, and dispensing with the usual processes of puddling, etc. For this purpose he first melts the ore in any convenient way, or he re-melts pig-iron and he taps a charge, preferably of about 10 tons' weight, into his improved refining "Manipulator." This consists of a cylindrical body or shell hung in trunnions mounted on its axis, and supported on a cradle-truck, which is carried on wheels. The shell is lined with any suitable material of a refractory nature, such as, for instance, a compound consisting of 96 parts of silica, about 2·3 parts of alumina containing some iron oxide, and about 2 parts of plumbago wetted moist and hand rammed. It is fitted with gear for rotating, and has an external chamber or box with movable cover, into which liquid compounds, air, gases, and other elements in a sub-divided state, are forced through holes in the refractory lining after entering through a central aperture in the shell and passing an internal chamber, which communicates with the external one. The charges, when finished, are withdrawn through a tapping hole. The liquid compounds spoken of above as forced into the metal are chlorine compounds, carbon and hydrogen compounds and oxyhydrogen compounds. These are first minutely sub-divided or "atomised" in an apparatus hereafter described, and are carried forward into the body of the metal in the manipulator by either atmospheric air or other gases, which may either serve as carriers only or may be used partly for chemical action in combination with the atomised liquids. The "Atomiser" for preparing the liquid compounds and conveying the air gases into the metal, consists of a horizontal vessel or reservoir, to which the blast is connected at one end and an outlet provided at the other. Upon the reservoir are fitted three or more cylindrical upright tanks, each connected with it through a pipe and valve. Another pipe is tapped to the top of each tank, and reaches on the inside nearly to the bottom. These latter pipes convey the liquid to atomising injectors and to a mixing box, whence the mixture passes through a connecting pipe and valve into the external chamber of the manipulator previously referred to. There are also gauges, valves, floats, and supply pipes to regulate the quantity of the various liquids admitted to the tanks. Absorbents of carbonic oxide or of iron oxide from the charge of metal may be added to the charge in the manipulator as required, and it may also be stirred with wood poles for absorbing the oxygen, similar to what is practised in the manufacture of copper. When the treatment of one charge is completed the manipulator may be removed on its truck, and another previously filled with molten metal substituted for it, thus making the operation continuous. A sheet of drawings representing the manipulator and the atomising apparatus accompanies the specification.—B.

Improvements in the Extraction of Cobalt, Nickel, and Manganese from their Ores, and of Nickel from its Ores, when such Ores are found in a similar condition to those of New Caledonia. Henri Herrenschmidt, Boudi, near Sydney, N.S.W. Eng. Pat. 12,044, September 5, 1884.

The patentee deals with the extraction of metal from two kinds of ore found in New Caledonia—viz., the manganiferous ores of cobalt and nickel, and the plain ores of nickel. Where both kinds of ores are to be treated at the same place, the manganiferous ore is first manipulated by placing it in a solution of proto-chloride of iron, and heating to boiling, when the cobalt, nickel, and manganese will dissolve. From the solution the cobalt and nickel are precipitated by the addition of a sufficient quantity of sulphide of manganese or hydrated oxide of manganese. The supernatant liquor being a solution of pure chloride of manganese, is either crystallised for marketable purposes, or evaporated at a moderate heat, whereby hydrochloric acid is driven off, and oxide of manganese obtained as residue. The plain ores of nickel are now treated with the hydrochloric acid by heating the latter, and using it as a bath for these ores until the complete dissolution of the nickel, which is then precipitated from the solution as before. Or the hydrochloric acid obtained as above may be used for the production of proto-chloride of iron for the treatment of the manganiferous ores, and thus the process carried on in a continuous round of operations involving very little loss.—B.

TABLE OF EXPERIMENTS ON STEEL.

Experimental No.	DESCRIPTION OF EXPERIMENT. cc.=cubic centimetres.	The BICHROMATE SOLUTION contained of $K_2Cr_2O_7$ in 1000 cc.	THE ACIDULATED CHROMIC SOLUTION.			Steel actually taken.	Second portion of Chromic Solution used, and weight of Iron is able to dissolve.	Carbide obtained per 100 of Steel.	Percentage of the Total Carbon in the Steel obtained as Carbide.	ANALYSIS OF THE CARBIDE.				Carbide heated with HCl. (*Carbon* not converted into Hydrocarbons.)		Experimental No.
			H_2SO_4 added per 1 gramme of $K_2Cr_2O_7$	Amount of Solution employed						Weight taken for Analysis.	Per 100 Carbide.			Per 100 Carbide.	Per 100 Carbon of Carbide.	
				contained CrO_3 =grammes of $K_2Cr_2O_7$	contained Free H_2SO_4 sufficient for Dissolving Iron.						Water.	Carbon.	Iron.			
		Grammes.	Grammes.	Grammes.	Grammes.	Grammes.	Grammes.			Gramme.						
1	The Unfused Cemented (L) Dannemora Steel, as received from rolling	88·06	0·9	1000cc. 84·46	9·11	8·20	250cc. = 2·28 Fe	11·69	82·7	0·4287	0·77	6·66	93·68	0·62	9·31	1
2	,,	89·55	2·74	1000cc. 79·14	36·36	8·32	200cc. = 7·27	1·91	25·1	0·1123	7·30	12·39	81·07	...	...	2
3	,,	,,	,,	,, ,,	,,	14·25	,, ,,	1·31	...	0·1194	...	...	46·94	16·83	...	3
4	,, (used 500cc. of the solution of Exp. 2 +500cc. water)	,,	,,	,, 39·57	18·18	7·68	250cc. = 4·54	1·69	15·2	0·0810	2·5	8·4	93·9	...	...	4
5	,, (used 1000cc. of the solution of Exp. 1 +37 grammes H_2SO_4)	,,	1·34	1020cc. 84·46	16·15	7·88	200cc. = 3·17	8·64	81·5	0·3377	2·70	8·88	87·80	3·00	33·78	5
6	,,	69·14	1	1500cc. 100·00	12·69	7·87	250cc. = 2·12	12·54	95·8	0·4612	1·08	7·19	91·85	1·24	17·25	6
7	The Unfused Cemented (L) Dannemora Steel, Annealed	88·83	1	1500cc. 127·11	16·13	7·63	250cc. = 2·69	12·82	89·2	0·4569	1·33	7·06	91·81	1·18	16·71	7
8	,, Hardened	,,	,,	,, ,,	,,	8·72	,, ,,	0·92	...	0·0395	...	2 (?)	101 (?)	...	...	8
9	,, Annealed (Repeat Exp.)	101·54	1	1500cc. 144·33	18·32	7·14	250cc. = 3·05	12·50	87·4	0·4760	1·66	7·10	91·50	1·16	16·34	9
10	,, Hardened (,,)	,,	,,	,, ,,	,,	8·02	,, ,,	0·48	...	...	...	...	...	...	...	10
11	,, Annealed (,,)	89·98	1	1500cc. 128·72	16·33	6·36	250cc. = 2·72	13·54	92·8	0·4279	0·98	6·96	92·09	1·17	16·81	11
12	,, Hardened (,,)	,,	,,	,, ,,	,,	7·30	,, ,,	0·98	...	...	...	...	...	...	...	12
	Steel of Mr. Paget's Series F:—															
13	Annealed	80·05	1	1000cc. 76·70	9·73	9·18	250cc. = 2·43	15·51	87·5	0·4609	1·23	6·39	88·77	...	...	13
	,,							,,	,,	0·4276	1·05	6·47	89·64	...	...	
	,,							,,	,,	...	...	...	88·76	1·07	16·61	
14	Hardened	,,	,,	,, ,,	,,	9·23	,, ,,	0·76	4·7	0·0341	...	6·7	95	...	...	14
	The Cemented (L) Dannemora Steel, Tempered:—															
15	Straw Temper	75·97	1	1500cc. 109·44	13·89	8·72	250cc. = 2·32	7·43	59·2	0·4695	2·22	7·40	89·51	...	...	15
16	Blue Temper	,,	,,	,, ,,	,,	8·75	,, ,,	3·95	31·9	0·2371	1·52	7·41	89·83	...	...	16
17	Straw Temper (Repeat Exp.)	113·90	1	500cc. 53·64	6·81	3·10	150cc. = 2·04	4·24	33·8	...	...	...	...	...	...	17
18	Blue Temper (,,)	,,	,,	1500cc. 160·91	20·42	8·76	350cc. = 4·76	1·09	16·1	...	...	...	...	...	...	18
	Fused Steel. Tempered. 24 discs:—															
19	Straw, Metal Bath, 15 minutes	104·34	1	1500cc. 148·11	18·79	8·40	250cc. = 3·13	5·25	32·5	...	...	...	...	...	...	19
20	,, ,, ,, Hard half-disc	,,	,,	500cc. 49·37	6·26	2·93	84cc. = 1·04	4·90	30·3	...	...	...	...	..	...	20
21	,, ,, ,, Soft half-disc	,,	,,	,, ,,	,,	2·97	,, ,,	5·00	30·9	...	...	...	...	...	...	21
22	Straw, Hot Chamber, 6 hours	,,	,,	1500cc. 148·11	18·79	8·31	250cc. = 3·13	2·52	16·0	0·1496	1·48	7·31	90·08	...	...	22
23	Blue, Metal Bath, 15 minutes	,,	,,	,, ,,	,,	8·42	,, ,,	2·37	15·4	...	...	...	...	..	...	23
24	Blue, Hot Chamber, 6 hours	,,	,,	,, ,,	,,	8·59	,, ,,	4·61	29·3	...	...	...	...	...	...	24
	The same; repeat Experiments:—															
25	Straw, Metal Bath, 15 minutes	111·29	1	1500cc. 157·41	10·97	8·53	250cc. = 3·33	5·18	32·0	0·3987	2·46	7·10	90·26	...	...	25
26	Straw, Hot Chamber, 6 hours	,,	,,	,, ,,	,,	8·69	,, ,,	5·30	34·2	0·4081	2·63	7·42	90·46	...	...	26
27	Blue, Metal Bath, 15 minutes	,,	,,	,, ,,	,,	8·54	,, ,,	3·02	19·7	0·3497	2·77	7·29	87·76	...	...	27
28	Blue, Hot Chamber, 6 hours	,,	,,	,, ,,	,,	8·68	,, ,,	6·66	42·3	0·5302	1·27	7·11	91·22	...	...	28
	The same; repeat Experiments:—															
29	Straw, Hot Chamber, 6 hours	113·82	1	750cc. 80·40	10·20	4·09	200cc. = 2·72	5·66	30·0	...	...	...	...	...	...	29
30	,, ,, ,,	,,	,,	750cc. + 150cc. water 80·40	,,	4·42	200cc. + 40cc. water = 2·72	5·52	35·1	...	...	...	...	...	...	30
31	Blue, Metal Bath, 15 minutes	113·90	1	750cc. 80·46	10·21	4·10	200cc. = 2·72	3·05	22·0	0·1790	3·23	8·09	90·07	...	...	31
32	,, ,, ,,	,,	,,	,, ,,	,,	4·45	,, ,,	3·14						...	...	32
33	Blue, Hot Chamber, 6 hours	113·82	1	750cc. 80·40	10·20	4·35	200cc. = 2·72	6·60	41·9	...	...	...	...	...	...	33
34	,, ,, ,,	,,	,,	750cc. + 150cc. water 80·40	,,	4·14	200cc. + 40cc. water = 2·72	6·76	42·9	...	...	...	...	...	...	34
	Recalculation, according to equations *a* and *b* (like the above solutions), of the data of the solutions used for Preparations 1–4 in Report to Institution of Mechanical Engineers, January, 1883.															
	Solution for Preparation 1	79·1	0·9	1000cc. 76·2	8·22	7·2	125cc. = 1·03 Fe									
	,, ,, Preparation 2	99·0	0·9	1250cc. 118·0	13·48	7·5	125cc. = 1·35									
	,, ,, Preparation 3	43·6	0·9	2000cc. 83·1	9·49	7·4	250cc. = 1·19									
	,, ,, Preparation 4	...	0·9	1900cc. 258·3	29·55	14·7	350cc. of a rather stronger solution = 6·26									

Improvements in the Process of working Auriferous and Argentiferous Arsenides and Sulphides of Iron, Copper, or other similar Substances by Litharge or Lead. Edward Probert, San Francisco, California. Eng. Pat. 15,057, November 15, 1884.

THE invention relates to an improved method of stirring the molten materials in the process of working auriferous and argentiferous arsenides and sulphides of iron, copper, or other similar compounds in which litharge or lead is introduced for the purpose of extracting the precious metals. The improvement consists in a novel mode of stirring the materials by means of elastic vapour generated by the action of the molten mass upon substances placed within the melting pot, and without the aid of mechanical stirring. The inventor takes iron pots of conical shape and lines them inside with a refractory material worked in the plastic state. He then places upon the bottom a further lining of suitable thickness, composed of mineral carbonates, mixed with a sufficient quantity of the original lining material to give it consistency. After being slightly dried for the removal of the excess of water the pots are ready for use. When the molten material from the furnace is tapped into the pot, and simultaneously therewith or immediately after the charge of litharge or lead, the evolution of steam and carbon dioxide causes a considerable and very regular ebullition and agitation of the materials, with the effect of inducing an intimate mixture of the ingredients. The duration of the action can be regulated to suit the quantity and the heat of the molten mass, as well as its composition, by altering the thickness and the composition of the calcareous bottom. Other means than that described may be used for holding the calcareous materials to the bottom of the pot within the molten mass.—B.

XI.—FATS, OILS, AND SOAP MANUFACTURE.

A New or Improved Process for the Separation of Glycerine from Fatty Substances. C. Rumble and F. Sear. Eng. Pat. 4264, March 1, 1884.

ZINC or magnesium salts of fatty acids are first prepared by boiling together in an open vat with free steam, dilute alkaline solution, fatty substances, and zinc or magnesium sulphate. The fatty substance to be deprived of its glycerine is then heated with one-third its weight of water, and from 5 to 8% of the zinc or magnesium salt of fatty acids, to a steam pressure of 120 to 130lbs. per square inch, and a temperature of 368° F. The glycerine is separated from the "sweet water" in the usual way, and the zinc or magnesium soap may be decomposed by a mineral acid, the salts so produced being employed over again.—W. L. C.

An Improved Method or Process of, and Apparatus for Recovering Paraffin, Stearin, or similar Wax-like Substances from Petroleum or other Oil. Communicated by Rollin H. Smith, Pennsylvania, to H. H. Lake. Eng. Pat. 13,579, December 15, 1884.

THE usual mode of separating the solid constituents of oils from the liquid ones, is by filtration or by pressure, heavy hydraulic presses being usually employed. The patentee proposes to effect the same object by spraying the oil upon a travelling blanket, which afterwards passes between pressing rollers; the oil is squeezed out, and the solid portions, which are left on the belt, are removed from it by a scraper, and carried away by a travelling belt. The process is rapid and continuous, but requires very close attention to the temperatures of the room, and of the oil. The spraying apparatus is a pipe furnished with a number of "bib-cocks."—W. L. C.

Improvements in Lubricating Compounds. Communicated by D. D. Wass, of New York, to A. M. Clark, London. Eng. Pat. 5901, December 30, 1884.

THE patentee mixes 1lb. paraffin with 1lb. mineral oil and $\frac{1}{10}$lb. of alcohol. $\frac{1}{20}$lb. of powdered talc is well stirred in. The mixture when cold is pressed and made into cakes, balls, or "cartridges," which are dipped into melted paraffin, and thus become covered with a protecting shell of paraffin.—W. L. C.

Improvements in the Manufacture of Soap. C. R. Alder Wright. Eng. Pat. 14,681, January 12, 1885.

DR. WRIGHT proposes to counteract the evil effects on the skin or on fabrics, of the free caustic soda or potash often to be found in soap, by mixing with the soap some ammoniacal salt (usually sulphate or chloride), the acid of which combines with the free caustic alkali, while the liberated ammonia gradually passes away into the air during the subsequent operations of cutting, stamping, etc. Even if a little free ammonia remain in the soap, it is not nearly so deleterious as the fixed alkali.—W. L. C.

Improvements in Obtaining Glycerine and Fatty Acids from Animal and Vegetable Substances. J. W. Freestone. Eng. Pat. 7573, February 10, 1885.

THE fat is heated in an autoclave for four or five hours at a pressure of 100 to 125lb. per square inch, with one-half its volume of water, and from ½ to 1 per cent. of hydrated oxide of magnesium, prepared by precipitating magnesium chloride with milk of lime or caustic soda, and washing the precipitate. The mixture of fatty acids and magnesic soap may be at once saponified, or treated first with a mineral acid.—W. L. C.

Improvements in Extracting Grease from Soap-water, and its Subsequent Bleaching and Purification. Benjamin Davy. Eng. Pat. 4679, February 23, 1885.

THE soap-water in calico printing works is treated, in tanks at 50° F. or upwards, with sulphuric or hydrochloric acids; the clear liquid is decanted, and the fat separated by filtration. The fat is then hot-pressed, and the grease from the hot-presses is clarified and bleached with "sulphuric or hydrochloric acid and common soda."—W. L. C.

XII.—PAINTS, VARNISHES, AND RESINS.

Rubber Compositions. J. J. C. Smith, Passaic, N.J., U.S.A. Eng. Pat. 15,150, November 18, 1884.

THIS specification relates to the production of a vulcanisable composition of india-rubber or caoutchouc combined with ozokerit, mineral wax or paraffin and sulphur. The ozokerit is first melted with rosin, and the caoutchouc and sulphur are added, the mixture then being removed to a regular rubber mill, after which it is ready for working into articles in the same manner as other rubber compounds. The inventor states that by the addition of rosin, together with ozokerit, a perfect union of the rubber and sulphur with the mineral wax is effected, and a much stronger and more elastic composition produced.—E. G. C.

Improvements in the Manufacture and Preparation of Drying Oils. Miles Williams, Wigan. Eng. Pat. 579, January 3, 1884.

ACCORDING to this invention, a drying oil "medium" for paints, etc., is prepared by distilling colophony in an iron still. Pyroligneous acid and water first pass over, and the temperature is maintained at 315-320° F. until the resin is freed from these compounds. The temperature is then raised, until the resin boils and crude resin oil distils over. The oil, if required to be very pale, is rectified by redistillation, or by being heated for about ten hours to a temperature of about 300° F., and is finally mixed with a suitable dryer, such as the oxides of lead, manganese, etc. The resulting oil is transparent, free from bloom, has good drying properties, and forms a hard, tough, glossy surface, which, when dry, does not contract or crack. It moreover possesses a sweet smell, and will mix in any proportions with other boiled and drying oils; it is soluble in turpentine, and is a good solvent for gum-resin or varnish gums.—E. G. C.

An Improved Mode of Treating Certain Resins for obtaining a New Elastic Substance.

A. Germot and L. Rivière, Paris. Eng. Pat. 2630, February 2, 1884.

As the result of numerous experiments, the inventors have proved that oleic acid from stearin works will entirely dissolve solid and semi-solid resins. The degree of solubility varies with the nature of the resins to be dissolved, and the temperature required from about 50-150° Centigrade. The product of the solution thus effected is soluble in spirits of turpentine and in oil, and can, therefore, be used for the manufacture of oil varnishes. Solid and semi-solid gums are also soluble in ethylic and benzoic aldehyde, liquid or melted camphor and chloroform. "The solution of gum in the abovenamed aldehydes, and liquid or melted camphor and chloroform forms an elastic material, having equivalent properties to those of the material (elasteine) produced by the solution of the gums in oleic acid. The integral solution of copal gums in oleic acid (effected in a similar manner to that hereinbefore described) gives a product which is applicable not only to the manufacture of varnishes, but also of new plastic materials. Products varying in consistence may in fact be obtained by altering the proportions of the oleic acid and gum, as well as by varying the kind of gums employed." The product of the solution of the gums in oleic acid has sometimes the elasticity and consistence of india-rubber, and the inventors have given to this substance the name of "elasteine." It is suitable for the manufacture of varnishes, of coatings of all kinds for cloth, wire, etc., and for making insulating cloth by the incorporation of cork, fibrous or textile material, or mineral substances, with the elasteine. The ordinary process of dissolving solid and semi-solid copal resins in oil and in spirit of turpentine is somewhat dangerous and difficult, and it has to be carried out at a temperature at which about 25 per cent. of the resin to be dissolved is lost. This loss of resin is avoided if the inventors' process be adopted.

—E. G. C.

Manufacture of Weatherproof Oil Colours or Paints.

Otto Wolf, Saxony. From August Then Bergh, of Dresden. Eng. Pat. 2896, February 7, 1884.

A PROCESS for making oil colours or paints which are to be employed in cases where such preservation is deemed necessary. "Oil colours or paints have up to the present time not been manufactured with sufficient care." "The process of the conversion of the oil varnish into a resinous substance, and the facilitating of the said process so as to prevent the penetration of dampness, has not received sufficient attention; and, on the other hand, the hardening of the colour or paint by adding exceedingly hard substances has been overlooked, but is necessary to enable the colour or paint to withstand the injurious effects of the continuous friction of rain, dust, and sand." The inventor adds to the oil varnish a powder consisting of ground and calcined lead or silver slag, which is a very hard material. The said substance contains about 25 per cent. of SiO_2 and small quantities of

PbO, ZnO, SnO_2, FeO, CuO, Al_2O_3, MnO, $CaSiO_3$, and S.

"The said substance contains the above in such favourable proportions for the preparation of weatherproof oil colours, that in the opinion of competent experts, the so prepared oil colours or paints, with the addition of burnt colours in the various requisite shades, are perfectly able to withstand dampness and all atmospheric influences or effects of the weather, as the resinous process is not only facilitated by the addition of the aforesaid silicic compounds, but the paint or colour is also rendered hard or indestructible."—H. A. R.

Priming and Anti-fouling Compositions.

P. Laydon and W. McLean, Jarrow. Eng. Pat. 4796, March 12, 1884.

THE priming composition of the inventors consists of the following ingredients:—

1. Gum guaiacum in powder	3	parts.
2. Teak varnish	3	"
3. A varnish known as knotting varnish	2	"
4. Yellow resin or other resinous gum	12	parts
5. Benzoline or other spirit	20	"
6. Stockholm or other tar	5	"
7. Black varnish	5	"
8. Colouring matter	30	"

No. 4 is reduced to a fine powder and dissolved in part of No. 5; Nos. 1 and 3 are then thoroughly mixed together; Nos. 2, 6, 7, and 8 are next placed in a properly constructed mixing vessel, to which are lastly added gradually Nos. 1, 3, 4 and the remainder of No. 5. The whole is then briskly stirred for twelve hours, at the expiration of which period the composition is ready for use. The anti-fouling composition is prepared from the following ingredients:—

1. Metallic bronze powder, known as gold bronze powder	1	part.
2. Gum catechu in powder	5	parts.
3. Teak varnish	7	"
4. Schweinfurt or Vienna green	3	"
5. Yellow resin or other resinous gum	15	"
6. Benzoline or other spirit	30	"
7. Stockholm or other tar	5	"
8. Black varnish	6	"
9. Pure Prussian blue	3	"
10. Colouring matter	37	"

Nos. 2, 3, and 4 are thoroughly mixed together; No. 5 is reduced to a fine powder and dissolved in part of No. 6; Nos. 1, 7, 8, 9, and 10 are next placed in a mixing vessel, Nos. 2, 3, 4, and 5 and the rest of No. 6 being then gradually added. The mixture is now briskly stirred for a period of twelve hours, after which it will be ready for use. The compositions may be applied to surfaces with a brush in the ordinary manner; the anti-fouling is applied when the coating of priming has dried.

—E. G. C.

Improvements in the Preservation of Moist Colours.

H. F. Brousson. Eng. Pat. 4778, March 14, 1884.

THIS invention relates to a simple device for protecting the contents of the pans in which artists' moist colours are kept from becoming dry by exposure or useless through dust, etc.—H. A. R.

Improvements in the Manufacture of Red Pigments or Paints.

John Cowdery Martin. Eng. Pat. 5192, March 20, 1884.

THE improvements consist in treating red oxide of lead, or the oxide known as "orange lead," or a mixture of these, with white lead, as follows:—Inventor treats with a weak solution of carbonate of soda or potash, the quantity of alkali being from 1 to 2 per cent. of the other materials. Either acetic, nitric or other suitable acid, or else acetate or nitrate of lead is added in quantity sufficient to neutralise the alkali used, and the mass, which has assumed "a brilliant vermillion tint," is dried. The red colouring used, other than lead compounds is that known in commerce as "aniline scarlet," and the proportions of lead compounds and "aniline scarlet" vary according to the shade required. The lead compounds are made into a thin paste with water, the alkali added in solution, and the whole heated in a pan. After addition of the other ingredients, and when a thick paste has been formed, the colour is dried in a stove. The pigment resulting is ground into an oil paint in the ordinary way. Red pigments, termed "vermillionettes," are made by combining eosine with white lead and "white zinc," "but the colour of this material is extremely fugitive, and pigments made with it partake of this character." "The colour produced as above does not fade, and resists as an oil-paint long exposure to atmospheric influences equally well with genuine vermillion."—H. A. R.

Improvements in the Production of Compounds containing Nitro-Cellulose, suitable as Varnishes, and for making Leather Cloth.

William Virgo Wilson and Joseph Storey. Eng. Pat. 6051, April 7, 1884.

THE inventors claim the use of acetate of amyl as a solvent for nitro-cellulose. Such a solution can be used as a varnish for an infinite variety of articles. When 200 parts nitro-cellulose are mixed with 600 parts acetate of amyl a mass of a doughy consistency is obtained, which can be used for any of the purposes for which celluloid is used. With the addition of castor oil, China clay, and a small proportion of certain essential oils, a compound suitable for the production of artificial leather may be produced.—E. J. B.

Improvements in the Manufacture of Euphorbia Paints. S. R. Hooper. Eng. Pat. 39, Jan. 1, 1885.

In the utilisation of euphorbia juice with pigments it has been the practice simply to mix the same with ordinary paints. The said juices become more or less dissolved out or impaired by moisture, and *thus* the paints in a great measure lose their preservative properties. Inventor adds certain water-repellent materials previous to mixture with colours or pigments. For general use it is proposed to combine equal parts of euphorbia juice and a solution of gum resin,—*e.g.*, shell-lac.—H. A. R.

XIV.—AGRICULTURE, MANURES, Etc.

Proceedings of Convention of Agricultural Chemists, Philadelphia, 1884.

The Convention proceeded to formation of an "Association of Official Agricultural Chemists," for which analytical chemists connected with State Agricultural Departments, Experimental Stations, and Boards are alone eligible as members. The object is to secure legislative uniformity by the different States for the sale of, and uniformity and accuracy in the analysis of, commercial fertilisers. The Association adopted methods for—

1.—Determination of phosphoric acid in fertilisers, as, Total, water-soluble, and citrate-insoluble, phosphoric acid, the sum of the last two deducted from the total to give the citrate soluble, neutral ammonium citrate solution to be used of 1·09 density, the P_2O_5 to be precipitated by molybdic solution, and converted by magnesia mixture into ammonio magnesic phosphate, burnt, and weighed. Solutions of ammonium citrate, magnesium nitrate, *magnesia mixture, ammonium* nitrate, and molybdic acid to be prepared and used as directed.

2.—Potash in fertilisers is to be determined by aliquot part of 10grm. in 1000cc., representing 0·5 to 1·0grm., precipitated first by barium chloride, filtered, then barium hydroxide. Careful removal of all excess of baryta by ammonium carbonate, evaporation, re-solution, and soda and potash weighed as pure dry chlorides, the potash then precipitated by excess of *platinum tetrachloride.* The atomic weights adopted are :—

Platinum	197·18	Chlorine	35·46
Potassium	39·13	Oxygen	16·00

—J. R.

Improvements in Silos. J. B. A. M'Kinnel, Dumfries. Eng. Pat. 6008, April 5, 1884.

This specification is accompanied by drawings, and "the improvements consist in forming the ordinary built up or earth-embedded chamber with a hollow cover or casing, which serves to cover the fodder, and when filled with water or liquid, to apply pressure to the material within the chamber." The hollow cover is formed to correspond with the shape of the silo, and the upper end of the cover is fitted with a broad flange, which rests on the containing-walls of the silo, when the lower or piston-like part of the cover is fully down, it can then be cemented or fitted air-tight. The silo chamber is first filled with the grass or fodder, and the cover brought to bear on it. The hollow casing is filled with water until the weight compresses the material sufficiently. This process of filling and compressing is repeated as often as is necessary. To facilitate raising and lowering the cover it is suspended by chains passing over pulleys on carrying columns, fitted with counterbalancing weights or water-tanks.—W. M.

Improvements in Obtaining Certain Solutions containing Free Phosphoric Acid. E. Packard, Jun., Ipswich. Eng. Pat. 6176, December 19, 1884.

The liquid portion of the product obtained by acting upon phosphate of lime with dilute sulphuric acid (mixed or not with phosphoric acid) is separated from the solid residue, and this latter washed at least twice in wooden filterpresses. The first wash, mixed with strong sulphuric acid, is used for treating a further quantity of phosphate, while the second wash is utilised as the first wash for the next lot of solid residue. If more than two washings are given the same principle applies.

—A. R. D.

Improvements in Obtaining very Pure and Rich Superphosphates of Lime. E. Packard, jun., Ipswich. Eng. Pat. 6750, December 19, 1884.

Native or other phosphate of lime is treated with sulphuric acid in the presence of sufficient water to obtain a solution of monocalcic phosphate and free phosphoric acid. This solution is separated *from the solid* sulphate of lime, etc., and evaporated to a density of from 1·125 to 1·300. This causes almost the whole of the sulphate of lime and phosphates of iron and alumina originally existing in the solution to precipitate, while *arsenic*, if present, is removed by a current of sulphuretted hydrogen, or the addition of a suitable sulphide such as alkali waste. One filtration may serve to remove these impurities, and the filtrate may be evaporated to any required degree of dryness. —A. R. D.

Improvements in Obtaining from Native or other Phosphates of Lime, Products Rich in Phosphoric Acid and of a High Degree of Purity. E. Packard, jun., Ipswich. Eng. Pat. 6751, December 19, 1884.

Phosphate of lime is treated with sulphuric acid and water in such proportions as to yield the greater portion of the phosphoric acid in the free state. The solution is separated by filtration, and evaporated to a sp. gr. 1·125-1·300. Sufficient phosphate or carbonate of lime, or free lime, is then added to leave only about 30 per cent. of the phosphoric acid (not combined with iron and alumina) still in the free state. This causes the deposition of the sulphate of lime, and phosphates of iron and alumina contained in the phosphoric acid solution. The liquor filtered from these precipitated impurities is concentrated *as* required.—A. R. D.

Improvements in Obtaining from Native or other Phosphates of Lime Products Rich in Phosphoric Acid. E. Packard, jun., Ipswich. Eng. Pat. 6752, December 19, 1884.

To a solution obtained by treating phosphate of lime with sulphuric acid in such proportions *that nearly* the whole of the phosphoric acid (exclusive of that combined with iron or alumina) is obtained in the free state, lime, or carbonate of lime is added in such quantity as will combine with about two-thirds of the free phosphoric acid. The resulting product is evaporated to the degree of dryness required.—A. R. D.

XV.—SUGARS, GUMS, STARCHES, ETC.

On Raffinose (Melitose?), a Kind of Sugar of High Rotating Power derived from Molasses. B. Tollens, Ber. Chem. Germ. 1885, pp. 26-28.

Some molasses which had been treated with strontium hydrate in the usual *manner* were allowed to stand for two years, when they appeared to be intersected by numerous needle-shaped crystals. Alcohol of 80 per cent. was added in such quantities that the mass could be filtered. *After pressing and repeated crystallisation* white needles were obtained, containing about 15 per cent. of water. An elementary analysis showed C = 42·46 % and H = 6·50 % for the substance dried at 100° C., which corresponds to the *formula* $C_{12}H_{22}O_{11}$ +

3 H_2O for the hydrated crystals. The polarisation of a 9·5986 % solution showed in the Landolt-Laurent apparatus a rotation $(a)_r$ = 102·5°-103°. By heating this solution with a little sulphuric acid, the angle of rotation was reduced to less than half—viz., $(a)_r$ = 45°. The matter is indifferent to Fehling's solution, but after heating with sulphuric acid it reduces an alkaline copper solution. Treated with dilute nitric acid it yields a substance similar to mucic acid and fusing at 210°-214°. These properties do not agree with any of the known compounds of the formula $C_{12}H_{22}O_{11}$, but they correspond well with a kind of sugar prepared from molasses by Loiseau and termed "raffinose." This substance offers all the more interest at present as the sugars which were produced in the last few years showed a higher polarisation than could be expected from their percentage of pure cane-sugar. Raffinose having a higher power of polarisation than cane-sugar, it appears probable that since the introduction of the strontium process the sugar of commerce contains a certain amount of raffinose, which would, of course, raise the rotating power of the sugar. Furthermore, it does not seem unlikely that raffinose exercises an influence on the crystallisation of sugar by causing the crystals to take a longish shape. Tenne and V. Schaaf have made the same observation with sugar prepared by the strontium process. The investigation of this interesting body not being finished, the author refrains from pronouncing an opinion whether his and Loiseau's substance are identical. —S. H.

Experiments in the Manufacture of Invert Sugar from Saccharose. F. W. Thompson, Burton-on-Trent. Eng. Pat. 8686, June 7, 1884.

ANY commercial saccharose is dissolved in water in suitable proportions, and the solution is heated to from 95° F. to 160° F., preferably 130°. Whilst the solution is at that temperature, yeast, ordinary pressed brewer's yeast by preference, is added in the proportion of 1 part of yeast to 100 parts of saccharose, and allowed to stand for five hours. At the end of that time the saccharose is completely inverted. It is claimed that by using the yeast at this temperature, or even by heating the yeast before use to 120° F., it still retains its inverting power, though it can no longer produce fermentation or convert the sugar into carbonic anhydride and alcohol as it would do under ordinary circumstances.—A. J. K.

Improvements in the Process of and Apparatus for Treating Megass for Extracting Sugar therefrom. G. W. Parbury, London. Communicated from Gustav Kottman, Sydney, N.S.W. Eng. Pat. 17,002, December 31, 1884.

BY this invention the sugar is extracted as completely as possible from the canes by the old process of squeezing through mills, and then the megass which is left is afterwards exhausted by the application to it of the diffusion process in a modified form invented by the authors. The apparatus designed for carrying out the process receives the megass either directly from the mills or after it has been more or less disintegrated by a special cutting or tearing machine. The diffusion apparatus (the construction of which cannot be exactly explained without reference to the diagram) is so arranged that the megass is made to rotate round a large cylinder in the opposite direction to a stream of hot water, until when the exhaustion is complete the megass passes out to another mill to receive a final squeeze, and the sweet water is separately drawn off and taken to the factory for treatment.—A. J. K.

XVI.—BREWING, WINES, SPIRITS. Etc.

On the Presence of Choline on Hops. Dr. Griess, F.R.S., and Dr. G. H. Harrow. Abstr., Proc. Chem. Soc. 1884-5 [5], 35.

THE authors have separated choline—

$$C_2H_4(OH).N(CH_3)_3OH,$$

from hops by adding to a concentrated extract, acidified with hydrochloric acid, a solution of iodine in hydriodic acid. The semi-solid precipitate obtained—a choline periodide—was boiled with water to expel iodine, and the resulting solution of choline iodide treated with silver oxide; the impure choline in the solution was then converted into the auro-chloride, which was recrystallised. In this manner they have not been able to obtain more than $\frac{1}{20}$ per cent. of choline from hops. They consider it not improbable that it exists in loose combination with resin, as they find that a very dilute aqueous solution is capable of dissolving comparatively large quantities of hop resin, the liquid being then of intensely bitter taste. Employing the same method, they have also extracted choline from beer.—W. S.

Analysis of Two Californian Wines. J. L. de Fremery. Ber. 18, 426.

THE author has obtained the following results on analysis of a red wine "Zinfandel," and a white wine "Gutedel." 100cc. of wine gave in grms. :—

	Cabinet Gutedel.	Zinfandel.
Extract	2·0909	2·127
Alcohol	10·45	9·8
Mineral constituents	·1978	·2218
Volatile acids	·0801	·0972
Fixed acids	·1815	·4110
Tartar	·1579	·1428
Free tartaric acid	·0060	—
Other free acids	·5850	·5325
Sulphuric acid	·0381	·0168
Phosphoric acid	·0220	·0193
Chlorine	·0036	·0051
Lime	·0056	·0084
Magnesia	·0170	·0160
Iron	·0009	·0010
Alumina	·0003	·0001
Potash	·0973	·1055
Soda	·0019	·0035
Glycerine	·6133	·5617
Sugar	·0165	·0276
Succinic acid	·0068	·0097
Malic acid	·0324	·0922
Tannin	·0317	·1554
Colouring matter	·0085	·0520
Specific gravity (at 15° C.)	·9907	·9923
Polarisation	±·2	±·0
" after inversion	±·0	±·0

—A. G. G.

Fuchsin in Wine. R. Kayser. Rep. Analyt. Chem. 4, 296-301.

100 CUB. CENTS. of the wine to be tested are shaken with 20 cub. cents. of colourless amylic alcohol, and then after diluting with water, the solution is examined with the spectroscope. If the characteristic absorption bands between the lines D and E of rosaniline compounds are observed, then the author recommends adding excess of ammonia solution to the sample of wine, and again shaking with amylic alcohol. If the alcohol solution is coloured red, then ordinary rosaniline has been the colouring matter employed; but if the alcoholic extract remains colourless, then the spectroscopic reaction is due to magenta S (rosaniline sulphonate). If these tests have given negative results, 100 cub. centimeters of the wine is warmed with excess of finely-powdered barium hydrate for two hours on the water-bath, and after cooling, the precipitate is filtered off and washed with water till the filtrate has a volume of 100 cub. cents. The filtrate is then evaporated to 10 cub. cents., acidulated with weak acetic acid, and examined spectroscopically for rosaniline salts and sulphonate. The precipitate may contain fuchsin, to obtain which lead acetate and ammonia are added, and the mixture well shaken with amylic alcohol, and the alcoholic extract again tested with the spectroscope. The sediment deposited by the wine may contain the rosaniline in combination with tannic acid, and can be examined in the way above described.—S. R.

Examination of Wine for Cane-Sugar. L. Medicus, Rep. Analyt. Chem. 4, 327-329.

THE author has examined pure white wines for cane-sugar before and after warming with hydrochloric acid, and finds that there is a greater quantity of reduced copper after inversion. The method used was that of Soxhlet-Allihn. This increase he attributes to the inversion of a gum in the wine which he has succeeded in precipitating by the addition of alcohol, and by inverting the viscid precipitate obtained with hydrochloric acid and then reducing with copper solution has proved that the increased power of reduction of the wine after inverting is entirely due to this body. In estimating the sugar in wine the author finds it necessary to heat for the same length of time in all cases. With light-coloured wines it is not necessary to decolourise. With red wines animal charcoal must be used with caution; lead acetate, however, removes the colouring matter without carrying down the gummy substance along with the precipitate.—S. R.

Estimation of Glycerine in Wine. M. Barth. Pharm. Centralb. 25, 483-488.

THE amount of sand and lime added for the estimation of glycerine has an influence on the preciseness of the results. The author finds that with a quantity of wine which would yield 2grm. of extract, 1·3-1·5grm. of calcium hydrate should be added, and in ordinary wines 2grm. of sand, but with sweet wines it is best to have as much as 5grm. of sand to the same quantity of calcium hydrate. If these proportions of lime and sand are adhered to, no marked influence on the result is observed, whether the wine is evaporated almost or quite to dryness, if one takes care to dissolve all the residue off the dish. By observing these conditions one can obtain with 100 cub. cents. of the hot alcoholic filtrate 97 per cent., and with 150 cub. cents about 99-99·5 per cent. of all the glycerine.—S. R.

XVII.—PRESERVING FOOD, MEATS, Etc.

Improvements in the Manufacture of Meat Powder, and Methods for using the same. M. Bauer, Paris. Eng. Pat. 16,700, December 19, 1884.

THE object of this invention is to manufacture a new description of meat powder, without using a higher temperature than 167° F., from which all danger arising from bacteria has been removed, and which, although not subjected to boiling, is suitable for consumption as food. The meat, cut into thin slices, is placed in hot water for several minutes, then removed, and placed in a water bath, which is kept boiling for one or two hours. The meat is now minced, and the broth from the former process is evaporated and added gradually to the minced meat, which is heated to 160° F., until all the water is driven off.—W. M.

Improvements in the Manufacture of Preserved Meat and Vegetables, and Method of Packing the same. M. Bauer, Paris. Eng. Pat. 16,701, December 19, 1884.

THIS specification gives a detailed account of the manner in which certain proportions of meats and vegetables are to be prepared, steamed and stewed together, and finally hermetically sealed in tin cans.—W. M.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES AND EXTRACTS.

On Eucalyptol. E. Jahns. Ber. 17, 2041.

ACCORDING to Cloëz (*Compt. Rend.* 70, 687) the ethereal oil of the leaves of eucalyptus globulus consists, for the most part, of a substance, eucalyptol, which boils at 175°, and has the composition $C_{12}H_{20}O$. Faust and Homeyer (*Berl. Ber.* 7, 63), on the other hand, obtained a liquid boiling at 171-174°, which contained no oxygen, and appeared to be a mixture of cymol and a terpene. They considered their product, however, to be identical with that of Cloëz. The author points out that Cloëz obtained his oil by the distillation of the leaves of eucalypus globulus grown in Paris; while that of Faust and Homeyer was bought from a druggist in Leipzig; and he doubts whether they worked with the same substance. The author subjected some oil, obtained from Hr. Tromansdorff, in Erfurt, to fractional distillation, and found that the greater part came over between 170 and 180°, the residue consisting of terpenes and traces of phenols. It was not found possible to obtain a constant boiling product from this oil, nor from samples supplied by Merck, in Darmstadt, and Schimmel and Co., in Leipzig. Analyses were made of the different fractions between 171 and 178°; and it was found that the composition of the lowest boiling portion agreed with the formula $C_{10}H_{18}O$, while Cloëz's formula approximately represented the composition of the highest boiling fraction. That the product was a mixture was shown by the analyses, and by the different optical properties of the fractions. The substance was purified by the method of Wallach and Brass (*Ann. Chem. Pharm.* 225, 291). Hydrochloric acid gas was passed into the oil, cooled by a freezing mixture, and the crystalline mass quickly pressed and decomposed by water; the oil was again precipitated with *hydrochloric acid. It was then* warmed with alcoholic potash, washed with water, dried and distilled. It boiled constantly at 176-177°; its specific gravity was 0·923 at 16°; and it was optically inactive. Its odour resembled *that of camphor. Its composition was found* to be $C_{10}H_{18}O$. A study of its physical and chemical properties proved its identity with the substance to which the two names, cyneol and cajeputol, have been given.

—S. Y.

On Juglone. A. Bernthsen and A. Semper. Ber. deut. Chem. Ges. 18, 203.

THIS is a lengthy paper on the preparation, properties, and probable constitution of juglone, a substance obtained by extracting nutshells with ether. Juglone seems to be a naphthalin derivative, and possibly an oxynaphthoquinone having the empirical formula $C_{10}H_6O_3$; it crystallises in shining red needles, is easily soluble in chloroform and glacial acetic acid, less soluble in alcohol and ether. It has acid properties, but the salts are not easy to obtain. An acetyl derivative was prepared. Oximides of juglone were obtained by reaction with hydroxylamine chloride; and juglonic acid *obtained by the action of nitric acid* appears to be a dinitro-oxyphthalic acid of the formula $C_8H_4N_2O_9$.

—G. H. B.

On the Conine Group. A. W. Hofmann. Ber. 18, 5-23.

FOR a very long time the following formulas for conine and conhydrine were generally accepted:

Conine $C_8H_{15}N$. Conhydrine $C_8H_{17}NO$.

The latter base was therefore considered as the hydrate of the former, and this supposition seemed to be confirmed by Wertheim's experiments, who is stated to have converted conhydrine into conine by the abstraction of a hydroxyl molecule, by means of phosphorus pentoxide. On the other hand, the author recently proved that the formula *of conine was undoubtedly* $C_8H_{17}N$, and it was then thought that conhydrine may have the composition of $C_8H_{19}NO$, although some observations did not quite correspond with this presumption. On repeating *Wertheim's experiments, the author found that* the resulting basic oil was not of a uniform composition, but at any rate it contained no conine. The oil contains two or perhaps even three isomeric but different bases, represented by the *formula* $C_8H_{15}N$, which was *formerly* ascribed to conine. For these bases the terms of α and β-coniceïne are proposed.

1.—*Action of hydrochloric acid on conhydrine.*—Four parts of strong hydrochloric acid were treated with 1 part of conhydrine in a sealed tube at 220° C., for four hours. The resulting mass was supersaturated with an alkali, and the free bases appeared on the surface as an oily layer which after separating, was purified by distilling with steam. After removing the water and dehydrating with potassium hydrate, the oil commenced to boil at 150°, and the principal fraction distilled between 155° and 175° C. On saturating it with hydrochloric acid two salts could be easily distinguished, which were separated from each other by converting them into picrates, one of which is only slightly soluble, whereas the other is easily soluble in alcohol. The free base of the first—α-coniceïne—is a colourless liquid boiling at 158°, and has the same smell and physiological properties as conine. It solidifies at 25° C., and its sp. gr. is 0·893 at 15° C. Then follows a description of some derivates.

2.—*Conversion of conine into α-coniceïne.*—If 1 mol. conine hydrochlorate be mixed with 1 mol. bromine and an alkali be added, a bromine derivate of α-coniceïne is formed, thus:

$$C_8H_{16}NH + BrBr + NaOH = C_8H_{16}NBr + NaBr + H_2O.$$

By treating it with sulphuric acid it is changed into hydrobromic acid and α-coniceïne, thus:

$$C_8H_{16}N\,Br = H\,Br + C_8H_{15}N.$$

3.—*Reconversion of α-coniceïne into conine.*—On digesting α-coniceïne with a great excess of hydroiodic acid (sp. gr. 1·96) and a small quantity of common phosphorus in a sealed tube at 200° C., α-coniceïne is partially reconverted into conine.

4.—*Reduction of Conine to Octane.*—Conine was heated with hydroiodic acid in a sealed tube at 300° for 8-10 hours. The hydroiodic acid turns dark, and a colourless layer of octane appears at the top, whereas large quantities of ammonia are dissolved in the acid solution, and no conine is left. The reaction seems to proceed almost quantitatively, thus:

$$C_8H_{17}N + 2\,HH = C_8H_{18} + NH_3.$$

After separating and distilling over sodium it can be obtained in a pure state, boiling at 118° to 120°, and smelling exactly like petroleum. The author for the present reserves his opinion on the constitution of this hydrocarbon.

5.—*Bases formed by treating conhydrine with hydrochloric acid.*—As mentioned above, the product of the reaction of treating conhydrine with hydrochloric acid contains a mixture of bases, from which α-coniceïne was separated as a picrate slightly soluble in alcohol. From the alcoholic mother liquor an oily product is obtained, which after purification yields a colourless liquid boiling between 165° and 170°. This liquid, however, is a mixture of α and β-coniceïne, and very likely of a third coniceïne. By converting it into the chlorhydrate and frequent recrystallising a salt was produced which is a derivate of β-coniceïne. From this salt the free base was prepared. It forms white crystals, melting at 41° C., and smelling like conine. Its physiological properties are far weaker than those of α-coniceïne.

6.—*Action of hydriodic acid on conhydrine.*—On treating one part conhydrine with four parts hydroiodic acid and some phosphorus in a sealed tube at 150° C. for three to four hours, a quantity of colourless prismatic crystals is produced, which are easily soluble in hot water. The analysis showed them to be hydroiodate of conine iodide, thus:

$$C_8H_{17}NO + 2HI = C_8H_{16}IN.HI \text{ and } H_2O.$$

This salt is therefore a source of preparing conveniently α-coniceïne. The iodine can be easily separated by boiling the salt with silver nitrate. On digesting it with silver chloride the hydrochlorate of conine iodide is obtained, which readily combines with platinum chloride to $2\,(C_8H_{16}IN.HCl)\,PtCl_4$. By boiling hydroiodate of conine iodide with silver chloride all iodine is replaced by chlorine forming hydrochlorate of conine chloride, $C_8H_{16}ClN.HCl$. Reduced with tin and hydrochloric acid the iodised compound is converted into free conine. Wertheim's idea of the relation of conine to conhydrine is thus proved to be a mistake. The latter cannot be converted into the former by means of dehydrating agents, but this conversion can be really effected by the use of hydroiodic acid.—S. H.

Researches on the Conine Group. A. W. Hofmann. Ber. 18, 109.

The fundamental reaction of the research is the action of bromine on conine, and the products obtained are very various and depend on the relative quantities of the reagents employed. On account of the simpler character of the resulting reaction, bromine was caused to act on a salt of conine. A brominated compound is thereby formed of the formula $C_8H_{17}N.HBr.BrBr$. By the regulated action of sodium hydrate, the compound $C_8H_{16}NBr$ is obtained, and this gives rise to distinct isomeric bases by the different methods employed for the removal of HBr from this compound. These isomers are named α, β and γ-coniceïne, of the general formula $C_8H_{15}N$.; α-coniceïne is formed from the brominated compound by the action of sulphuric acid, and is a tertiary amine; β-coniceïne is a secondary amine and is described in a former paper along with the α-compound as products obtained from conhydrin; γ-CONICEÏNE is obtained by the action of an alkali on the brominated compound, and is also a secondary amine. It is noted that there are six possible isomers of $C_8H_{15}N$ according to present views. γ-CONICEÏNE is a colourless liquid base, lighter than water, in which it is little soluble, but sufficiently so to impart a strongly alkaline reaction. It smells like conine and is very poisonous. It boils very constant at 173° and forms volatile crystalline salts with acids. The formation of a definite double salt with tin tetrachloride is very characteristic. It is worthy of remark that the different coniceïnes could not be converted from one isomeric form into the other. Further products were obtained in the reactions giving rise to the coniceïnes. Dimethylhydroxyconiine was obtained as a colourless liquid base of peculiar odour, little soluble in water but with an alkaline reaction, and a boiling point of 225°. It forms very soluble, not easily crystallisable salts, and has the probable formula $C_8H_{15}(CH_3)_2NO$. TRIBROMOHYDROXYCONINE is a bye-product obtained in the preparation of γ-coniceïne. It is obtained in crystals which decompose spontaneously in the free state, but forms more permanent crystalline salts and also double salts with platinum and gold chlorides. It seems probable that this compound was a derivative of conhydrin, but the latter could not be obtained from the brominated base. Dibromohydroxyconiceïne is obtained from the tribrominated base by the regulated action of sodium hydrate. It is an oily body, and also liable to spontaneous decomposition, but its hydrochloride is not crystallisable. HYDROXYCONICEINE is obtained from the dibromohydroxyconiceïne by the action of tin and hydrochloric acid. It is a colourless liquid which boils between 210 and 220°, and forms a crystalline hydrochloride. It corresponds to the formula $C_8H_{15}NO$. CONICEIDINE is the name given to a base containing no oxygen, and obtained from hydroxyconiceïne by long distillation with inverted condenser in presence of alcoholic potash, during which the elements of water are eliminated. It crystallises in colourless needles, which melt at 55-56° and boil above 300°. The analyses of the crystalline hydrochloride and platinum salt determine its formula as $C_{16}H_{26}N_2$, and its formation from hydroxyconiceïne corresponds to

$$2C_8H_{15}NO = C_{16}H_{26}N_2 + 2H_2O.$$

This body is dibasic and may be provisionally viewed as a homologue of nicotine.

Nicotine $C_{10}H_{14}N_2$ New Base $C_{16}H_{26}N_2$.

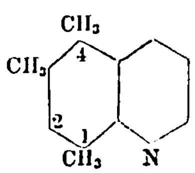
The latter part of the paper is devoted to a discussion of the possible constitution of the bodies of the conine group, which renders further experiments necessary before definite conclusions can be arrived at.—G. H. B.

Synthesis of Homo-quinine. O. Hesse. Annalen, 226, 240-242.

PAUL and Cownley have shown that homoquinine, when heated with caustic soda and then ether added, is resolved into a mixture of 52 per cent. of quinine, which dissolves in the ether, and 45 per cent. of cupreine, which remains dissolved in the soda. The cupreine can be thus obtained by crystallising from ethereal solution in colourless prisms aggregated together, and melting at 191°. Cupreine forms compounds with both acids and bases. If cupreine and quinine in the above proportions be dissolved in excess of weak sulphuric acid, then ammonia added and shaken with ether, homoquinine dissolves out, and can then be crystallised from the ethereal solution.—S. R.

Trimethylquinoline. L. Berend. Ber. 18, 376.

THE author has prepared this compound from pseudocumene (m. p. 63°) by Skraup's method. Trimethylquinoline melts at 42-43° C., and boils at 285-287° C. Owing to its extreme solubility in the ordinary solvents, it cannot be purified by recrystallisation. The analysis of the substance itself and also of the nitrate and the platinum salt, confirmed the formula $C_{12}H_{13}N$, and being derived from 1, 3, 4, 6 trimethylamidobenzene, its constitution may be expressed thus :—



—J. B. C.

On β-Naphthoquinolinesulphonic Acid I. C. Gentil. Ber. 18, 201.

β-NAPHTHYLAMINESULPHONIC acid in cohobated with glycerine, nitrobenzene and concentrated sulphuric acid, when a violent reaction sets in. β-naphthoquinolinesulphonic acid $C_{10}H_5(SO_3H):C_3NH_3 + aq$? is formed and is prepared in a pure state after previous conversion into the barium salt. The acid crystallises in groups of white needles, and is difficultly soluble in cold but easily in hot water. By fusion with potash a β-oxynaphthoquinoline $C_{10}H_5(OH):C_3NH_3$ is obtained.—G. H. B.

Separation and Estimation of Methyl-Alcohol in presence of Ethyl-Alcohol. Dingler's Polyt. Journ. 254, [12], 500.

C. DE PONCY describes in the *Génie civil*, 1884, v. 5, p. 353, the following method :—Both alcohols combine readily with oxalic acid in presence of gaseous hydrochloric acid. The methyl-oxalate is readily soluble in water, the ethyl-oxalate only difficultly soluble; the aqueous or alcoholic solution of both ethers, when treated with ammonia, gives amides quite insoluble in water. On these facts the estimation of the methyl-alcohol is based. 10·8grm. oxalic acid are dissolved in 10cc. of the alcohol to be examined, and hydrochloric acid gas is passed in to saturation. After standing for 24 hours in a closed flask, 2cc. of this solution are diluted and shaken with 10cc. water, and then filtered. As the methyl-oxalate is completely soluble in water, more oxamide will be obtained on the addition of ammonia, than would be the case if pure ethyl-oxalate only were present. A series of experiments establishes that the mean quantity of oxamide obtained from the wash-water is 6·6 per cent. for absolute ethyl-alcohol. For methyl-oxalate the number lies between 14·65 and 15 per cent. of the quantity of methyl-alcohol. If a mixture of ethyl- and methyl-alcohol be treated as above described, and the precipitated amides weighed, the percentage of methyl-alcohol present can be calculated. For every one per cent. methyl-alcohol from 0·14 to 0·15 per cent. more than 6·6 per cent. of oxamide is obtained.—G. H. B.

Process for the Estimation of Ethereal Oils. Dingler's Polyt. Journ. 255 [5], 216.

A. LEVANLOIS (*Comptes Rendus*, vol. 99, p. 977, 1884) estimates the ethereal oils in vegetable matters by distilling the latter with water in a short-necked distillation apparatus, and then adding bromine water until after energetic shaking a faint yellow colour remains. He finds that all the ethereal oils come over in the first portion of the distillate.—W. M.

XXII.—GENERAL ANALYTICAL CHEMISTRY.

New Laboratory Apparatus. H. Landolt. Ber. 18, 56.

(1.) A COMBINATION of water-bath and hot-water funnel. It consists of a box of copper (Fig. 1) whose bottom is 38cm. long and 25cm. wide, with a back 11cm. high and a front 9cm. high. The top is made of brass. The higher portion serves as a water-bath for beakers, wash-bottle, etc., which stand on a perforated plate 1cm. above the bottom. The front part has three openings for funnels. The apparatus stands on four legs, 20cm. high, one of which is provided with a set screw. At the bottom is a vertical screen to keep the gas flame from the funnels. The filtration and drying proceeds very quickly in using these hot funnels. (2.) Arrangement for concentrating very dilute solutions. A sloping box of copper (Fig. 2) is supported on three legs and provided with a corrugated and rimmed top, made either of silver-plated copper or thin platinum. At alternate ends of the gutters passages are provided in order to compel the liquid to proceed in a zig-zag way. By means of set screws the inclination of the apparatus can be altered.

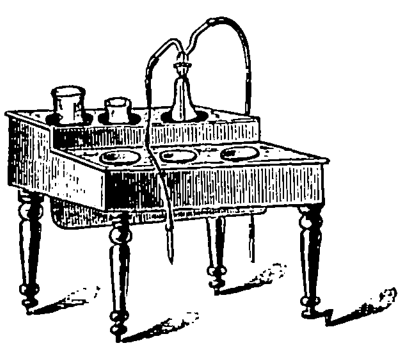


FIG. 1.

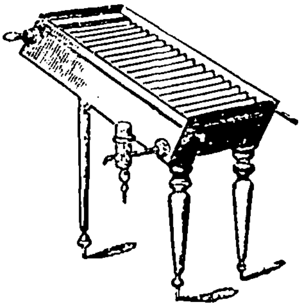
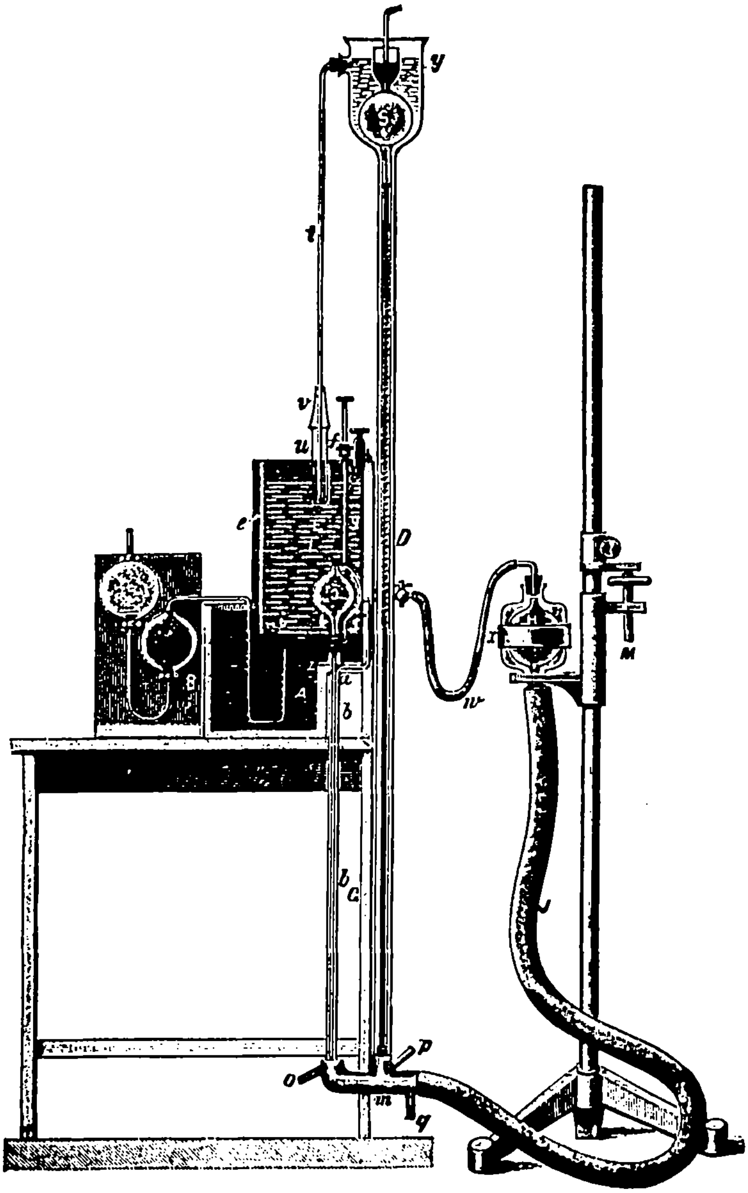


FIG. 2.

The box is filled with water through a gauge tube at the lower end, where it is also heated, whereas the steam escapes at the top end. The vessel containing the solution to be concentrated is placed in a high position, and by means of a syphon and a screw clip the feed is so regulated as to cause only a concentration and not the complete evaporation of the liquid. A part of the latter must therefore continually run off at the small overflow tube, which forms the continuation of the lowest gutter. A box, 38cm. long, 20cm. wide, and 10cm. high, with a total surface area of 850 square cm. evaporated more than one litre of water per hour. (3.) Apparatus for subliming. It consists of a thin platinum pipe 150mm. long by 18mm. wide, closed at one end and provided at the top with a stopper through which two glass tubes are inserted. Through one tube, reaching nearly to the bottom, cold water is allowed to flow into the pipe, which escapes through the second. The apparatus is inserted into the flask, which contains the mass to be sublimed, and after withdrawing it the sublimate can be easily scraped off. If the sublimation has to be performed in a crucible, the projecting portion of the pipe must be protected from the combustion gases by a covering of asbestos to prevent the condensation of water on the surface. It has proved impracticable to make the contrivance of glass, as it soon breaks owing to the great difference of temperature. Besides many sublimates—*e.g.*, iodine—adhere very obstinately to the glass.—S. H.

The Estimation of Oxygen in Atmospheric Air.

W. Hempel. Ber. 18, 267.



After an exhaustive notice of the causes which may influence the proportion of oxygen in the atmosphere, and a plea in favour of a periodical and accurate estimation of oxygen in air in different parts of the world, the author describes an apparatus for the determination of oxygen by absorption with liquid reagents capable of yielding very accurate results. The gases are measured over mercury and corrections for temperature, barometric pressure and aqueous tension are eliminated (as in other well-known apparatus) and the absorptions are made in special gas pipettes. The apparatus is a modified form of that described by the author in his book on "Neue Methoden zur Analyse der Gase." The figure shows a sectional sketch of the apparatus. It consists of an iron trough A, which is in communication with the graduated barometer tube D by the iron tube *b* and is made fast to the table G. The barometer tube is in connection at *m* through the rubber tube J with the levelling ball H. The upper part of the iron trough consists of a water vessel E, which can be connected with a cask to receive the overflow of water. The water vessel E is provided with glass sides reaching sufficiently low into the quicksilver to facilitate the introduction of the capillary tube of the pipette into the measuring ball C. The tubes *b* and D are enclosed in wider glass tubes, the rubber tube J of the movable level is double so that the tubes *b*, D and J can be kept cool by water, which flows into the apparatus during work at *o*, *p* and *q*. A part of the water enters at *o*, then flows along the tube *b* and enters through a small canal at *r* into the water vessel E. A second stream enters at *p*, passes along the barometer tube D and *s* into the water vessel through *t*. The small wide tube *u* hangs by threads on *t* and is useful in preventing the spitting occasioned by the air bubbles passing down *t*. A third stream enters at *q* into the double rubber tube *g* and goes towards E through the rubber tube *w*. In this way all parts of the apparatus are kept at the same constant temperature. The gas is measured in the glass ball C, at constant volume, determined by a mark on the neck, and is transferred for absorption of oxygen to the gas pipette B which contains pyrogallate of potash.

—G. H. B.

On a Lacmoid. M. C. Traub and C. Hock. Ber. 17, 2615.

The authors prepare a colouring matter closely resembling litmus in the following manner:—100 parts of resorcinol, 5 parts sodium nitrite, and 5 parts of distilled water are slowly heated in an oil-bath to 110° C. A vigorous reaction sets in, and the contents of the flask become red; when the reaction has moderated the mixture is heated to 115-120°, till the evolution of ammonia has ceased and the melt has become blue. It is then dissolved in water and precipitated by HCl. The product is a glistening reddish-brown powder, which is insoluble in chloroform, benzol, and petroleum spirit, easily soluble in methyl-, ethyl-, and amyl-alcohols, less soluble in ether and water. In all its properties it closely resembles the colouring matter of litmus, with which it is possibly identical. It can be conveniently used as a substitute for the latter as an indicator.

—A. G. G.

The Lacmoid as an Indicator. M. C. Traub. Arch. d. Pharm. [3], 23, 27-29.

The lacmoid prepared from resorcinol is a very useful indicator, being more delicate than ordinary tincture of litmus, and capable of more general application than phenolphthalein, whilst it can be very readily prepared. The indicator solution is prepared by dissolving ½grm. of the lacmoid in a mixture of 50cc. of alcohol (96 per cent.) and 50cc. of water. Blue test paper is prepared from a solution containing 1grm. of the lacmoid dissolved in a mixture of 500cc. of alcohol and 500cc. of water and five drops of a solution of KOH.—A. G. G.

An Improvement in the Apparatus used for Precipitating Copper by Electrolysis. H. C. Foote. American Chem. Journ. vol. 6, No. 5.

The author has devised a piece of apparatus for electrolytic determinations of copper, which possesses the advantage of maintaining a regular current of proper strength for several days, without a change of the battery fluids becoming necessary. The platinum dishes are arranged on a board, as shown in section by Fig. 2. The current from the battery is made to pass through a certain number of coils of fine insulated iron wire before it passes to the platinum dishes. Fig. 1 shows the under side of the board with the resistance coils and connecting wires sunk into it, so that no wires are visible above the board save the ones connected to the platinum strips dipping into the dishes. The current enters at *a* and passes to *c*, where it enters a switch, from which it may be made to pass directly to a switch at *g*; or it may be made first to traverse either one of the coils *m*, *n*, on its way, by a simple movement of the switch handle above the board. From *g* it may be made to pass through *h* to the switch at *r*; or by connecting the switch with *i*, *k* or *l*, the current will first traverse one, two or all of the coils *o*, *p*, *q*, and when it reaches *r* it will have the required strength. The coils have the following lengths of fine iron wire respectively: *m*, 1½ meters; *n* and *o*, 3 meters each; *p* and *q*, 4½ meters each. More coils may be added if it is desirable; but with the arrangement shown in the cut a resistance of 1½ meters may be obtained, which may be increased, by additions of 1½ meters each, up to 15 meters, by properly manipulating the switches *c* and *g*. For example: If the switch *c* be connected with *c*, and the switch *g* with *i*, the current will pass through 4½ meters of the iron wire. The board shown in the cut is arranged for only three dishes, but it will be readily seen that any number might be added. As the battery grows weaker, or as dishes are removed or added to the circuit, the strength of the current is kept uniform by manipulating the switches. This might be made to work automatically. The switch *r*, with its connections *s*, *t* and *u*, make it possible to use one, two or all of the dishes. If only one dish is to be used, the connection is made with *s*, and the current passes through the cylindrical copper connection *v''* (see also Fig. 2, *v*) to the platinum, and finally through *x''* to *b*. If two dishes are to be used, the switch *r* is connected with *t*, and the current passes first to the dish over *v'*, thence through the platinum strip to *x'*, and then to the second dish over *v''*. When all the dishes are to be used, connection must be made with *u*. The method of automatically regulating the current in the case of removing a dish from the circuit, is shown by Fig. 2—a coil of fine iron wire *w*, equal to the resistance of the solution in a dish placed under the board, and near each dish. Through the centre of the piece of platinum 3, 4, upon which the precipitating dish rests when in connection with the current, is a small hole, which is continued down through the board, and lined with a piece of copper pipe *v*, which is soldered to the platinum to make the connection. A short stick of wood 5, 6, passes through the pipe, and is so arranged with a spring 1, 2, that when the resistance coil *w* is in the circuit, the stick protrudes slightly above the platinum foil. When, however, a dish is placed upon the board it pushes down, by its weight, the stick 5, 6, removing the strip 1, 2, from contact with *v*, thus disconnecting the resistance coil, and at the same time causing the current to pass

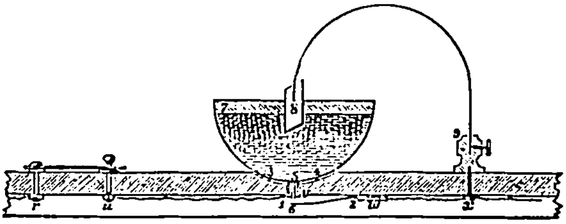


Fig. 2.

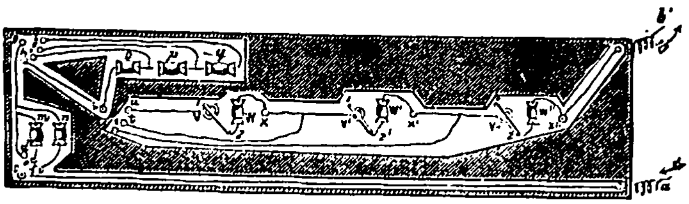


Fig. 1.

from v, through the solution and platinum strip to r. When a dish is removed, the current through 8, 9, is, of course, broken, and the spring 1, 2, comes in contact with v, making the connection with the resistance coil, which, being equal to the resistance in the dish, keeps the current the same in the other dishes. If two dishes are to be used, and the solution is only ready for one, the the switch r is connected with t, and the dish which is ready is placed on the platinum above v''. The current will then pass from t to v', and through the strip 1, 2, to the resistance coil w', and then through x' to v'', and finally through the liquid to x'' and b. When ready to add the second dish to the circuit, it may be done by simply placing the dish in its place over v', when it will automatically disconnect the resistance coil w'; and the strength of the current will remain the same, and sufficient for both dishes. Either one of the two dishes may now be removed at any time without altering the strength of the current, or in any way interfering with the work of the other dish in the circuit. The third dish may also be added at any time, by simply changing the switch r from t to u, and manipulating the switches c and g, so as to increase the current sufficiently. In the same manner, any number of dishes may be used. The strength of the current may be ascertained by passing it through acidulated water, in an inverted tube, graduated in cc., and noting the amount of mixed gases liberated in a minute.—J. B. C.

The Detection of Iodine in Presence of Large Quantities of Bromine. P. S. Brito. Chem. News, 50, 210.

If bromine and iodine be liberated by chlorine and the solution shaken up with chloroform, the violet colour of the iodine will be masked by the brown colour of the bromine when a large quantity of the latter is present. The violet at once appears on addition of ferric sulphate.
—J. B. C.

New Books.

Neue Methoden zur Analyse der Gase. Von Dr. Walther Hempel, Professor am Königl. Polytechnikum zu Dresden. Mit in den Text eingedruckten Holzstichen. Braunschweig: Druck und Verlag von Friedrich Vieweg und Sohn, 1880.

This work, important to all interested in technical gas analysis, is an 8vo volume, bound in paper cover and containing 129 pages of subject-matter, a table of contents, and twenty-two admirable woodcuts illustrating the apparatus in detail and in combined forms so as to indicate methods of working.

The Table of Contents will best illustrate the plan and method of the whole work. First Part—On Technical Gas Analysis. *I. General; II. Analysis by Absorption.*—Description of the Apparatus. THE GAS-BURETTES: A, the Simple Gas-burette; Mode of Handling the Gas-burette; The Modified Winkler's Gas-burette, B_1. THE ABSORPTION-PIPETTES, B_2. The Simple Absorption-pipette for Solid and Liquid Reagents, C. THE COMBINED ABSORPTION-PIPETTES—The Combined Absorption-pipette, C_1. The Combined Absorption-pipette for Solid and Liquid Reagents, C_2. Handling the Absorption-pipettes. General Details concerning the Conducting of Absorption-analyses. Recorded Analyses. Special Details on the Estimation of the Simple Gases: 1, Carbonic Acid; 2, Carbonic Oxide; 3, Oxygen; 4, Heavy Hydrocarbons. *III. Analysis by Combustion.*—1. The Combustion by Explosion. General Description of the Apparatus. The Explosion-pipette. 2. The Absorption of Hydrogen with Palladium. 3. Fractional Combustion. Second Part—On an Expeditious and Exact Gasometric Method. *IV. General Description of Apparatus.*—The Measuring Bulb. The Adjustable Mercurial Niveau C. The Gas-pipettes. Handling the Apparatus. Measuring. The Absorptions. Recorded Analyses. *V. The Mercurial Trough without Barometric Tube.*

Acetic Acid and Vinegar, Ammonia and Alum. (Churchill's Technological Handbooks.) London: J. & A. Churchill, 11 New Burlington Street, 1885.

Small 8vo volume bound in cloth. As the preface shows, the work is edited by Mr. John Gardner, F.I.C., F.C.S. It contains 193 pages of subject-matter, short table of contents, and an alphabetical index, and is illustrated with twenty-eight woodcuts.

The first chapter of the book is devoted to Acetic Acid and Vinegar, and this includes a description of the process of carbonising wood in close retorts and obtaining pyroligneous acid. The second chapter deals with Ammonia, and the third with Alum and Alum-making.

Monthly Patent List.

ENGLISH APPLICATIONS.

1885.

I.—GENERAL PLANT, APPARATUS, AND MACHINERY.

3597 L. H. Pearce, London. Improved means for heating liquids, applicable also for vapourising and distilling the same. March 20

3731 E. B. Petrie and A. S. Fox, Manchester. An improved composition to be applied to straps, belts, ropes, and brakes used in and in conjunction with machinery, which composition is also applicable to other articles for the purpose of protecting and preserving them from injury arising from moisture or exposure to the atmosphere. March 23

3736 W. R. Lake. Improvements in and relating to steam-boiler and other furnaces. Communicated by L. Broussas, France. March 23

3896 J. H. Johnson, London. Improvements in furnaces for burning pulverulent materials. Communicated by M. Perret, France. March 26

3921 L. W. Sutcliffe, London. Improvements in self-feeding and smoke-consuming furnaces and appliances for heating muffles and drying stoves and for other like purposes. March 27

4018 F. W. Gordon, London. Improvements in hot blast stoves. Complete specification. March 31

4270 G. H. Lilley, London. Improvements in mills for reducing solid crystalline substances to powder. April 7

4377 T. W. Barber, Ulverston, Lancashire. Improvements in hot blast apparatus. April 9

4580 J. McInnes, Glasgow. An improved tube for transmitting air or other fluids under pressure. April 11

4613 R. McQueen Weir, Boone, Iowa, United States. Furnaces. April 11

4619 A. M. Clark, London. Improvements in stone and ore crushers. Communicated by D. Brennan, jun., and G. G. Young, United States. Complete specification. April 11

4666 J. S. Booth, London. Improvements in the construction of boiler and other furnaces. Complete specification. April 15

4710 M. Keenan, London. An improved non-conducting composition for protecting boilers, cylinders, pipes, and other objects against radiation. April 16

4711 M. Keenan, London. Improvements in means for protecting boilers, cylinders, pipes, and other objects against radiation. April 16

4831 C. Jones, London. Improvements in apparatus used when heating vessels or chambers by steam-heated jackets. April 18

4835 P. Jensen, London. A system or combination of pumps for producing vacuum. Communicated by L. A. Riedinger, Germany. April 18

4889 F. Maxwell-Lyte, London. Improvement in crucibles, muffles, and other refractory apparatus. April 20

II.—FUEL, GAS, AND LIGHT.

3683 S. Clarke, London. Improvements in the manufacture of night-lights. March 21

3776 A. H. Reed, London. An improvement in the manufacture of hydrogen gas. Communicated by G. E. Moore, United States. Complete specification. March 21

3790 W. Black, Glasgow. Improvements in the manufacture of briquettes or fuel blocks. March 24

3870 R. Dempster, jun., Manchester. Improvements in the construction of condensers used in the manufacture or purification of gas. March 26